[Issued with Army Orders for June, 1927

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DEFENCE AGAINST GAS

1927

PROVISIONAL

By Command of the Army Council

H. J. Creedy

THE WAR OFFICE,
17th June, 1927

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.
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In accordance with the international agreement entered into by His Majesty's Government and the Governments of the self-governing Dominions and India, the British Government will, on the outbreak of war, endeavour, in conjunction with its allies, to obtain from the enemy Government or Governments an engagement that poisonous gas shall not be used as a weapon of war. In the event of failure to obtain such an engagement, His Majesty's Government will be free to take such action as circumstances demand.

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CHAPTER I

NATURE OF GAS WARFARE

1. *Necessity for defence against gas*

1. Gas was first employed in the Great War and proved itself to be an important weapon. It is therefore essential that adequate measures of defence against gas shall be provided, and that all ranks shall be trained in their use.

2. *Definition of gas*

1. The term, gas, in connection with warfare, is very loosely used but includes any chemical substance, whether a solid, a liquid, or a gas, employed for its poisonous or irritant effects on the human body. Such substances are, generally speaking, dispersed in the air as vapours or poisonous smokes, and exercise their action on personnel exposed to the contaminated air. Some of them, such as mustard gas, also act by direct contact of the liquid with the human body.

2. From a tactical point of view gases are generally divided into two main categories :—

Non-persistent, and
Persistent.

3. When liberated, non-persistent substances are rapidly converted into gas or smoke. Clouds of gas so produced continue to be effective until dissipated by the wind.

4. Persistent gases generally consist of liquids, which contaminate the area on which they are released and continue to give off vapours for a considerable period. Mustard gas and most tear gases are typical examples. Whilst evaporation is going on, the immediate neighbourhood down wind is dangerous. In the case of gases such as mustard, which attack the skin, contact with contaminated ground or objects must be avoided.

5. The persistence of a gas is affected by many factors, such as the degree of contamination, temperature, rainfall,

shelter from wind and nature of the soil. Warm weather, rainfall and high wind, all tend to reduce persistence. In the case of mustard gas, areas may remain infected for weeks.

3. *The effect of weather and ground on the use of gas*

1. *Wind.*—The effective use of gas is largely dependent upon weather conditions. Gas is most effective in light winds, and high winds will rapidly dissipate it.

Non-persistent gases are comparatively ineffective in a wind of over 12 m.p.h. Wind velocity is often affected by the target, *e.g.*, a wind of 20 to 25 miles an hour in the open may be reduced to one of only 8 miles an hour or less in thick woods, thus inviting a gas attack on such a target, when it would be ineffective on a more open one.

Chemical agents of the persistent type are not affected to the same extent by high wind.

When gas is liberated from cylinders, or special emitters, the direction of the wind is also important, but most other gas weapons may be used when the wind is in any direction.

When a large amount of mustard gas is used, it may be anticipated that the gas will be fired far enough back in the area attacked to prevent any of the vapour from reaching friendly troops. For this reason troops in reserve are more likely to encounter the mustard type of gas than those in the most forward areas. This is an important point in connection with defence against gas.

2. *Temperature.*—On warm, sunny days when the temperature of the earth is higher than that of the air, ascending air currents are formed which carry the gas upwards and disperse it. Warm weather also reduces the persistence of liquid on the ground. Extremely cold weather on the other hand limits the effect of persistent gas, as it reduces its rate of evaporation. Under such conditions, substances like mustard gas may freeze in the soil.

3. *Fog and rain.*—Foggy and cloudy weather is favourable for the use of gas. Light rainfall has very little effect, though heavy rainfall will tend to wash gas out of the air, and in most cases slowly destroy liquid on the ground.

4. The most favourable conditions for the use of chemical agents occur at night, or in the early morning, because strong winds and ascending currents are usually absent at these times. Further, at night, there is the possibility of effecting a surprise on sleeping men.

5. *Ground.*—The effect of the ground on gas may be briefly summed up as follows :—

Tall grass, bushes, trees, buildings, etc., retard the move-

ment of the air and in like manner the movement of vapours of chemical agents, thereby making them more persistent. In dug-outs, cellars, deep hollows, and other enclosed spaces, gases persist longer than in the open.

Most war gases being heavier than air tend to flow into gullies and valleys, leaving the tops of hills comparatively free. The effect of gas from projectiles will be diminished in marshy ground or in a shelled area where the craters are full of water. The effectiveness of gas clouds, on the other hand, is not appreciably reduced by passage over water.

4. *Action of gas on personnel*

1. War gases may be distinguished and grouped according to the predominant effect which they exercise on the human body. From the point of view of anti-gas defence, only three main classes need be considered. These classes are as follows and depend solely on the part of the body affected :—

i. *Lung irritants* which attack the lungs and breathing passages, *e.g.*, chlorine and phosgene; the severity of the effects depends upon the substance used.

ii. *Eye irritants*, or tear gases. Even in very small amounts these have an immediate and painful effect, causing so profuse a flow of tears that it is generally impossible to see. The effects soon wear off and there is no damage done to the eyes.

iii. *Skin irritants*, or blistering gases. These gases, of which mustard gas is the typical example, attack the skin and, in the worst cases, cause deep and extensive blisters. No pain is felt on contact with the liquid or the vapour and the effects do not show themselves until after a few hours. Mustard gas also attacks the eyes and lungs, and here again there are no immediate symptoms. This constitutes one of the greatest dangers in dealing with mustard gas.

2. The above classification is of a very general nature, since most gases act on more than one part of the human body. In fact, most war gases affect the eyes whatever action they may have upon other parts of the body.

3. The effects produced by any war gas depend on the strength of the gas and the length of time the personnel is exposed to it. The stronger the gas, the shorter the exposure required to produce death or injury.

A man must, however, breathe a definite quantity of any gas before it will injure him. With rare exceptions all gases will cause casualties if used in sufficient strength and for long

enough. On the other hand, under most conditions in the field, a single smell of any gas will do no harm and even a breath will generally do very little damage. It should therefore be impressed upon all ranks that when a man smells gas, even though it may be strong, he will probably remain quite uninjured if he keeps his head, holds his breath and adjusts his respirator without delay. It should also be emphasized that when gas is smelt or detected, the respirator must be worn, however little gas there may seem to be.

5. *How gas differs from other weapons*

1. The action of gas is distributed as regards space and time to a greater extent than that of any other weapon used in the field.

2. *Space.*—When an H.E. shell or bomb bursts there is no danger after the last fragment strikes the ground. With a gas shell on the contrary, the action only commences with the bursting of the shell.

The gas cloud drifts down wind and may produce casualties not only where the shell bursts, but at distances from it, at which there would be no danger from an H.E. shell.

By penetrating into dug-outs and underground shelters, gas can achieve results which would not be obtained from an ordinary shell.

3. *Time.*—In the case of a persistent gas, the area round the point of burst of the shell will be contaminated and will remain dangerous for periods which may sometimes extend to weeks.

Gas causes casualties in a different way from other weapons in that there is, in many cases, a delayed effect and the man who subsequently becomes a casualty may, at the moment he is gassed, be quite unaware of the fact. It is important that this delayed action should be thoroughly understood by all ranks, in order that its effects may not be regarded as mysterious.

Further, the necessity for being constantly upon the alert and the strain of wearing respirators for prolonged periods will have a bad effect upon morale, unless troops are well trained in defence against gas.

4. Adequate training in anti-gas defence is therefore essential, as by it the effects of gas can be almost entirely overcome.

6. *Methods of defence against gas*

1. Methods of defence against gas in which training is necessary, can be sub-divided as follows :—

i. Individual protection, by means of the respirator issued to each individual.

ii. Collective protection, which includes all general precautionary measures and arrangements for protecting groups of men, animals or equipment.

iii. Tactical protection, which comprises the disposition of troops in the manner best calculated to reduce gas casualties.

The above are dealt with in subsequent chapters of this pamphlet.

2. It is important that any material, either offensive or defensive, used by the enemy should be sent in. (Sec. **41**, F.S.R., Vol. II, 1924.) The material sent in should include such items as respirators, gas projectors, samples of earth soaked with any liquid which may appear to be a new gas, and any unexploded or captured shell, &c.

7. *Responsibility for anti-gas defence*

1. Responsibility for anti-gas defence rests with the officers commanding units.

2. **It cannot therefore be too strongly emphasized that these officers will be held responsible that all anti-gas appliances for protecting their men are maintained in good condition and that all ranks under their command are thoroughly trained in the use of these appliances and in all other measures which may affect their safet against gas.**

CHAPTER II

FORMS OF GAS ATTACK

8. *General*

1. *The objects of gas attacks.*—Gas attacks are made with one or more of three main objects:—

i. **To inflict casualties.**

ii. **To reduce the efficiency of troops** by compelling them to wear respirators with consequent reduction of their mobility and power of endurance, and by imposing the constant need for vigilance; in other words, for general harassing effects.

iii. **To render certain areas of ground dangerous to occupy.**

2. When troops are equipped with respirators and well trained in their use, serious casualties, apart from skin effects, can result only from defects in gas discipline, or from penetration of the respirator, or from some unexpected development in chemical warfare.

The first cause is avoidable, the second will be guarded against by continual attention to the design of the respirator, and the effects of the third will be minimized if commanders possess a knowledge of the possibilities of chemical warfare.

Good gas discipline implies not only that troops shall be well trained in defensive measures and practised in wearing respirators, but also that commanders and staffs are conversant with the powers and tactical uses of chemical weapons. Troops placed in unsuitable positions or retained in positions which have been heavily contaminated with substances like mustard gas, will sustain heavy gas casualties no matter how well trained the troops themselves may be. In most gas attacks some casualties due to surprise are inevitable, but good gas discipline will reduce these to a minimum.

3. Areas contaminated by such gas as mustard gas do not prevent properly protected personnel from passing over or occupying them for periods of time dependent upon the gas used, the nature of the ground and the weather. They do, however, compel troops to wear respirators, expose them to the

risk of casualties and limit the period during which the areas may be occupied without great difficulty and danger.

4. *Methods of gas attack.*—Gas may be discharged by many methods; from artillery shell and mortar bombs; from projector bombs; from aircraft, either in bombs or as a spray; in cloud form from cylinders; as poisonous smoke from generators; and from hand and rifle grenades.

9. *Gas shell attacks*

1. Gas shell bombardment is the type of gas attack which has up to the present been most usual. The long range of artillery and its ability to concentrate, with little or no warning, the fire of a number of guns on one target render artillery shell one of the most effective means of employing gas.

Except on targets close to friendly troops the use of gas shell is independent of the direction of the wind, though not of its strength.

The gas content of shells, however, is small for their weight compared with other gas containers, and gas shells must therefore be used in large numbers. For this reason their use in mobile warfare is likely to be restricted by the complications of ammunition supply.

2. Gas shell may be fired from all calibres of guns and howitzers and may contain any suitable chemical substance, whether solid, liquid or liquefied gas; liquids are generally used.

3. Gas shell may be expected whenever artillery is in action. Before an infantry attack, however, only non-persistent gases are likely to be used on the area over which the attack will be made, though persistent gas shell may be used on other areas.

By observing the distribution of the enemy's gas shell bombardments, valuable indication of his intentions may often be obtained.

4. Three main types of gas shell bombardment may be employed:—

i. **A short concentrated bombardment of a small target with non-persistent shell for the purpose of inflicting casualties by surprise.**—Frequently a rapid rate of fire is opened by several batteries for one or two minutes; alternatively, all guns that can bear may fire one round simultaneously. The object is to liberate suddenly a large amount of gas on the target and to produce casualties before respirators can be put on.

ii. **Harassing fire.**—This usually consists of a slow rate of fire with shell containing persistent gas, such as tear gas or of fire in short bursts at intervals depending on the persistence of the gas used. The objects are to compel the wearing of the respirator for long periods, to interrupt work, to interfere with active batteries, and to render the use of certain roads difficult.

iii. **Bombardments with persistent gas shell to render areas untenable** and to inflict casualties upon personnel occupying them. Fire of this nature may commence with a burst of fire upon some part of the area to inflict casualties by surprise, the whole area being afterwards subjected to a slow rate of fire. Mustard gas is the type generally used in such bombardments.

In all three types, H.E. shell may be mixed with gas shell to increase the difficulty of detecting the gas and to cause additional disorganization.

5. Ordinary gas shell, containing a liquid, can often be distinguished from other shell by the peculiar intermittent whirring noise they make in flight and by their small detonation. Shells containing a solid substance or a considerable proportion of explosives are indistinguishable from ordinary shell, so that the noise in flight and on bursting is not an infallible guide.

6. Under favourable conditions (Sec. **3**, 4), gas shell may cause a small low-lying gas cloud or "gas blanket" of great strength to form, resembling the mist which hangs over damp areas in the early morning. Even when composed of non-persistent gas, such a blanket may, in a gentle breeze, remain compact and highly effective for anything up to an hour, and will travel slowly down wind.

7. In normal circumstances, the cloud of gas produced by each shell is quite small and local and is quickly dissipated by air currents. On the other hand, when persistent gases are used, the ground which has been shelled may continue to give off a dangerous amount of gas and remain contaminated for days, or even weeks.

8. Mortars can also be used for the projection of gas, but their efficiency is limited by their comparatively short range.

10. *Projector attacks*

1. By means of projectors a large amount of gas can be suddenly set free and such attacks therefore constitute the severest test of anti-gas training. The projector is a simple

smooth bore gun, without a mounting, capable of firing only one shot in each bombardment, with a maximum range of about 2,000 yards. With the present type of projector, the materials and labour required to prepare an attack are considerable and a large attack can be staged only in position warfare.

2. Indications of the installation of projectors by an enemy may be obtained from aeroplane photographs, since it is difficult to camouflage a position completely. It should be noted, however, that projectors can be dug in, loaded and fired in one night, provided sufficient labour is available. They are usually sited some way back from the front line trenches and would not normally be discovered in a raid.

3. A projector attack can generally be recognized without difficulty. When projectors are fired a huge flash or series of flashes is seen and a loud explosion is heard. The drums flying slowly through the air make a peculiar whirring sound ; sometimes a trail of sparks from the fuzes is seen, while the subdued explosions as the drums burst give unmistakable information that a projector attack has been delivered. The enemy may attempt to mask the discharge by opening heavy machine-gun or artillery fire on the target just before the discharge is made.

If sentries are alert, adequate warning of the attack can be given, since the drums take about 15 seconds to travel 1,500 yards, the average range.

4. The cloud produced is very strong indeed, much stronger than can be obtained in the field by any other means. A few breaths in the vicinity of the bursting drums are likely to prove fatal. The cloud forms a blanket of gas of considerable size which travels along with the wind and may be effective for a considerable distance from the place at which the drums burst.

11. *Gas cloud attacks*

1. Gas cloud attacks on a large scale are limited to position warfare and depend upon the wind being in the right direction A special look-out should therefore be kept when the wind blows from the enemy's lines.

2. The characteristic feature of a gas cloud attack is that the gas liberated will affect an area extending several miles down wind, the gas flowing silently along with the wind. Defects in the alarm arrangements may lead to heavy casualties. Gas clouds may be emitted from cylinders concealed in trenches or from vehicles carrying cylinders or special gas tanks, brought into position under cover or during darkness.

3. It is not easy to discover beforehand the imminence of a

gas cloud attack; the possibilities may be judged from maps and photographs but definite knowledge can be obtained only by raids, by information given by prisoners and agents, or by the escape of gas from a cylinder hit by a chance shell or bullet.

4. The discharge may be made either by day or by night, but the latter is most often chosen since conditions are more suitable and the chances of effecting surprise are increased. (Sec. **3**, 4.)

5. At the moment of discharge, warning is given by the loud hissing of the gas escaping from the cylinders; attempts to drown this noise may be made by opening machine-gun or artillery fire at the same time.

The cloud is normally white from condensed water vapour, but the actual location and width of front may be disguised by the liberation of smoke.

12. *Poisonous or toxic smoke attacks*

1. A poisonous smoke cloud is indistinguishable from a gas cloud or a cloud of harmless smoke except by its effects. Some little warning may, however, be afforded by the fact that generators usually emit a thin smoke for several seconds before they begin to give off the full volume of gas. The few particles thus generated, arriving before the main cloud, will produce their characteristic irritant effects to a small degree and will thus give a warning to alert troops.

2. A poisonous smoke attack by means of small hand generators is the mobile warfare counterpart of a gas cloud attack. It can be carried out without special troops and with but little preparation, whenever weather conditions are favourable.

13. *Gas attacks from the air*

1. The employment of gas by aeroplanes and airships is quite practicable and must be anticipated. Aircraft bombs may contain a high proportion of gas since they need only be stout enough to be handled and have not to withstand the shock of discharge from a gun.

2. Another possible method of gas attack from the air consists in spraying a liquid poison, such as mustard gas, from tanks carried by aircraft, whence it falls like rain.

14. *Gas grenades*

1. Small quantities of gas may be filled into hand and rifle grenades. Hand grenades filled with tear or irritant gases have been used to clear dug-outs and other enclosed places.

In a retirement further opportunities for their use might occur to contaminate buildings, enclosed places, roads and paths with persistent gases, and so forbid their use for a time to the advancing troops. Rifle grenades may be used against defended posts and machine-gun emplacements.

15. *The employment of smoke in conjunction with gas and other uses of gas*

1. *Smoke.*—Gas and smoke may be used together. In the attack, small quantities of gas may be introduced into an ordinary smoke screen to hamper the defenders by compelling them to wear respirators. Smoke clouds may be used to extend the flanks of a gas cloud discharge so as to conceal the extent of the actual gas front. During a gas cloud or poisonous smoke attack on a wide front, lanes may be arranged in the cloud consisting of harmless smoke through which a raiding party might be able to approach unhampered by respirators.

2. *Gas.*—Liquid gas may also be liberated from containers carried by tanks or other vehicles for the purpose of contaminating roads and communications and so hampering an enemy's advance.

Persistent gases such as mustard gas and tear gas could be extensively and effectively used in this way, and might have a delaying power equal to that of extensive demolitions. Gas "booby traps" may often be set by a retreating enemy, while rooms, dug-outs, etc., may be contaminated.

2. Page 17.—*Add* new section :—

"**15A.** *Early information as to the use of gas*

Amdt. 2 Jan. 1929.

It is very important that commanders should receive early information as to an enemy's use of gas, or of his intentions to use gas in the field. To this end all ranks should be instructed to be on the look out for respirators on prisoners, or any of the indications mentioned in the previous section, which would suggest that gas had been, or was likely to be used. In the event of gas being used, it is most important that reliable evidence of the nature of the gas should be obtained, and for this purpose the location of blind shell with unusual markings and fragments of shell or other projectiles which contain residues of peculiar smelling substances, should be reported and dealt with under instructions from an officer trained in chemical warfare duties. Prisoners' respirators, and samples should be suitably packed in tins or bottles marked "urgent," and forwarded to headquarters as quickly as possible.

Care should be taken in handling these samples since they may contain substances which will cause burns or other injuries."

CHAPTER III

INDIVIDUAL PROTECTION

16. *General*

1. The first and most vital consideration in defence against war gases is that all ranks shall be provided with efficient appliances for the protection of the eyes, nose, mouth, throat and lungs from the effects of gas, and with such other protective devices as may be deemed necessary.

2. It is essential that all ranks shall be so trained as to be able to:—

i. Maintain the service respirator in an efficient condition and adjust it properly in the shortest possible time.

ii. Take full advantage of any other protective devices which may be available.

iii. Wear the respirator continuously for long periods and be so accustomed to it that its inevitable physical disadvantages may be reduced to a minimum.

iv. Carry out their duties, of whatever nature, by day or night, and use their weapons with the maximum possible efficiency whilst protected against gas.

3. In addition to the provision of protective appliances and to the training of the soldier in their use, it is desirable that men should, when possible, be taught to recognize by sight, smell or taste, the main types of gases which may be encountered, both for their own protection and so that they may spread the alarm without delay. **Troops should be trained to such a degree of gas discipline that at the first sign of a gas attack they will immediately and instinctively take the necessary steps to protect themselves and to warn others.**

17. *The service respirator*

1. The service respirator is designed to protect the eyes and lungs for long periods against the highest concentrations of any poisonous gases and smokes likely to be encountered.

2. It consists of a facepiece, joined by a flexible rubber tube, to a metal box or container filled with chemicals. The chemicals are designed to remove poisonous matter from the air passing through the container. The facepiece is designed to protect the eyes from gas and to ensure that only air which has passed through the container is breathed; valves are fitted to the container and the facepiece to guide the circulation of the air. The whole is carried in a special haversack.

3. There are two patterns of container, the training container and the service container. The former contains charcoal and a few pads and, whilst it gives efficient protection against most gases, does not protect against all. The pads will stop coarse smokes, but not the poisonous smokes used in warfare. On mobilization, it will be replaced by the service container, which is similar in shape, size and resistance to breathing, but which contains chemicals and pads designed to protect against all gases and poisonous smokes likely to be encountered.

18. *The army pattern facepiece, Mark III*

1. The facepiece is made of rubber sheet, covered on the outside with khaki stockinet. It is held in position on the face by six elastic bands, which run to the back of the head. Buckles are provided on each elastic at the side of the facepiece, to enable adjustments for length and comfort to be made.

2. The eyepieces are made of specially prepared splinterless glass so that they will remain gas-tight even when the glass is cracked, and since the glass breaks without splintering, the eyes will be protected from cuts.

3. There is neither mouthpiece nor noseclip in the Mark III design. An aluminium valve holder connects the facepiece to the flexible tube and also contains the outlet valve. Air is drawn in through the valve holder (from the container) and along passages in the material of the facepiece itself to outlets at the side of the eyepieces and so into the space between the facepiece and the face of the wearer. The eyepieces thus have a current of air continually passing over them which reduces the risk of dimming. As the air is breathed out, it passes directly through the valve holder and outlet valve to the outer air.

4. The flexible tube is made of rubber covered with stockinet; it is corrugated to give flexibility and to prevent collapsing and so impeding the passage of air, when bent. The ends are wired on to the valve holder and to the neck of the container.

5. Over 80 per cent. of individuals can be fitted with the normal (Size 3) facepiece. A large size (Size 4) is also available, and, for exceptional cases, special facepieces can be

provided, e.g., for facial deformities and scars. The gas officer or instructor will submit precise information as to requirements in such cases.

The number denoting the size of the facepiece appears in raised characters on the inside of the facepiece, between, and on a level with, the lower edges of the eyepieces. It is also printed on the front of the facepiece on the stockinet in the centre of the forehead and about ¼-inch from the edge.

19. *The training container, Mark II*

1. The training container, Mark II, is a tinned iron box weighing about 1¼-lbs. At the bottom is the inlet valve through which the air enters. At the top is a brass neck to which the corrugated connecting tube is secured.

The container is painted grey and the date of assembly is stamped on the lid.

20. *The respirator haversack*

1. The respirator haversack is made of khaki waterproofed canvas and is divided into two compartments, one to hold the facepiece, the other to hold the container. The anti-dimming outfit is carried in the same compartment as the facepiece.

2. The sling is adjustable for length by means of a brass buckle. To facilitate quick adjustment to the alert position, a brass stud is fixed in the sling; this fastens into a leather tab at the side of the haversack and the latter is thereby brought to the correct position on the chest.

3. The haversack is further provided with a yard of whip-cord fastened to one corner and two brass rings or "Ds," for the purpose of securing the haversack to the body when the respirator is carried in the alert position.

4. At the bottom of the compartment intended for the container is a wire platform upon which the container rests; this allows free access of air to the inlet valve. This platform is only required for the training container. *See attached.*

21. *The anti-dimming outfit, Mark II*

1. The anti-dimming outfit, Mark II, consists of a stick of special composition wrapped in tinfoil and of a piece of cloth, enclosed in a cylindrical metal box. Instructions for use, which are printed on the box, are as follows:—

> "Clean eyepieces with cloth provided. Smear a little compound on inside of eyepiece and rub with cloth until compound is spread evenly over eyepiece. If compound is too stiff to spread easily after application, soften by breathing on glass. Always apply as much compound as possible without making eyepiece misty."

1. Page 20, Section 20, paragraph 4. *Add* :—

"On mobilization when the mobilization conta into use, the platforms will be removed and R.A.O.C. for storage."

The anti-dimming material should be applied before the respirator is put away in the haversack after use.

2. One anti-dimming outfit is supplied with each respirator; renewals may be obtained as required.

22. *Care of the respirator*

1. The respirator has been designed to withstand reasonable wear and tear during use in the field. If properly cared for, it will last a long time. The most serious causes of damage to it are:—

i. Water entering the container and affecting the efficiency of the chemical filling.

ii. Injury to the outlet valve.

iii. Injury to the fabric of the facepiece or the elastic head-harness.

iv. Prolonged storage in the haversack without use.

1. Page 21, Section 22, paragraph 3. *Delete* and *substitute*:—

"3. Unless worn at frequent intervals facepieces become distorted and develop cracks in the rubber where it is folded in the haversack, especially if the facepiece is folded incorrectly. Particular care should therefore be taken to see that facepieces are folded as laid down in Practice 7, Appendix I. All ranks should wear their respirators at frequent intervals—at least once a month. Similarly respirators in store should be removed from their haversacks at least

Amdt. 3 May, 1929.

Amdt 4 1930.

1. Page 21. Section 22.—*Add* new paragraph:—

1. Page 21. Section 22.—*Delete* paragraph 4A (as promulgated by Amendments (No. 5) notified in Army Order 27 of 1931).

Amdt. 5 1931

carried in the haversack except the respirator and anti-dimming outfit; small articles of kit readily cause damage to the facepiece. It must be remembered that a single small defect may render the entire respirator unfit for use, and since the repairs that can be done in units are very small, damage to the respirator generally involves its replacement.

6. Care must be taken in cleaning the haversack or the waterproofing of the fabric may be destroyed. Scrubbing with water or cleaning with blanco are forbidden, but special approved preparations, such as waterproof khaki-blanco, may be used. Mud can be brushed off easily when the haversack is dry;

1. Page
"On m
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1. The respirator has been designed to withstand reasonable wear and tear during use in the field. If properly cared for, it will last a long time. The most serious causes of damage to it are:—

i. Water entering the container and affecting the efficiency of the chemical filling.

ii. Injury to the outlet valve.

iii. Injury to the fabric of the facepiece or the elastic head-harness.

iv. Prolonged storage in the haversack without use.

2. Respirators must be protected from wet and when not in use.

1. Page 21, Section 22, paragraph 3. *Delete* and *substitute*:—

"3. Unless worn at frequent intervals facepieces become distorted and develop cracks in the rubber where it is folded in the haversack, especially if the facepiece is folded incorrectly. Particular care should therefore be taken to see that facepieces are folded as laid down in Practice 7, Appendix I. All ranks should wear their respirators at frequent intervals—at least once a month. Similarly respirators in store should be removed from their haversacks at least once a month and aired." Amdt. 3 May, 1929.

21. Section 22.—*Add* new paragraph:—

Facepieces will only be cleaned in accordance with instructions laid down, at intervals to be fixed at the discretion of the officer i/c anti-gas training." Amdt. 5 Feb. 1931

Amdt 4 1930.

6. Care must be taken in cleaning the haversack or the waterproofing of the fabric may be destroyed. Scrubbing with water or cleaning with blanco are forbidden, but special approved preparations, such as waterproof khaki-blanco, may be used. Mud can be brushed off easily when the haversack is dry;

The anti-dimming material should be applied before the respirator is put away in the haversack after use.

2. One anti-dimming outfit is supplied with each respirator; renewals may be obtained as required.

22. *Care of the respirator*

1. The respirator has been designed to withstand reasonable wear and tear during use in the field. If properly cared for, it will last a long time. The most serious causes of damage to it are:—

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ii. Injury to the outlet valve.

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Amdt. 3 May, 1929.

Amdt. 4 May, 1930.

The facepiece and head-harness should be allowed to dry before being put away in the haversack."

5. Rough usage must of course be avoided. Nothing must be carried in the haversack except the respirator and anti-dimming outfit; small articles of kit readily cause damage to the facepiece. It must be remembered that a single small defect may render the entire respirator unfit for use, and since the repairs that can be done in units are very small, damage to the respirator generally involves its replacement.

6. Care must be taken in cleaning the haversack or the waterproofing of the fabric may be destroyed. Scrubbing with water or cleaning with blanco are forbidden, but special approved preparations, such as waterproof khaki-blanco, may be used. Mud can be brushed off easily when the haversack is dry;

] [illegible]ugo.

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22. *Care of the respirator*

1. The respirator has been designed to withstand reasonable wear and tear during use in the field. If properly cared for, it will last a long time. The most serious causes of damage to it are:—

i. Water entering the container and affecting the efficiency of the chemical filling.

ii. Injury to the outlet valve.

iii. Injury to the fabric of the facepiece or the elastic head-harness.

iv. Prolonged storage in the haversack without use.

2. Respirators must be protected from wet and when not in use should be kept, if possible, in a cool, dry, dark place.

3. Prolonged storage of the respirator in the haversack tends to cause distortion of the facepiece and cracking of the rubber where it is folded. This can be prevented to a great extent by frequent wearing of the respirator. C.Os. should therefore ensure that respirators in possession of officers and men are worn at least once a month, or oftener if possible.

2. Page 21, Section 22, paragraph 4.—*Delete* and *substitute* :—

"4. After use and after disinfection, the head-harness and the inside of the facepiece should always be wiped dry before being put away. If wet from exposure to the rain, the facepiece and head-harness should be allowed to dry before being put away in the haversack." Amdt. 4 May, 1930.

5. Rough usage must of course be avoided. Nothing must be carried in the haversack except the respirator and anti-dimming outfit; small articles of kit readily cause damage to the facepiece. It must be remembered that a single small defect may render the entire respirator unfit for use, and since the repairs that can be done in units are very small, damage to the respirator generally involves its replacement.

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6. Care must be taken in cleaning the haversack or the waterproofing of the fabric may be destroyed. Scrubbing with water or cleaning with blanco are forbidden, but special approved preparations, such as waterproof khaki-blanco, may be used. Mud can be brushed off easily when the haversack is dry;

7. To prevent the freezing of the outlet valve of the face-

3. Page 22, Section 22, paragraph 7, line 4.—*After* " match " *insert* :— Amdt. 1 1.24

" ; with the facepiece, Mark IV, treatment of the outlet valve with glycerine is unnecessary."

inlet valve of the training container is not affected by frost, if kept dry. If moisture has entered and frozen, the valve must be removed, thawed, wiped dry and replaced. Inlet valves must not be treated with glycerine.

23. *Respirator inspection*

1. Page 22, Section 23.—*Delete* paragraph 1 and *substitute* :—

" 1. Respirators will be inspected frequently by the company &c. officer who will verify that respirators are Amdt. 1 March, 1928.

3. Page 22, Section 23, paragraph 2 (as amended by Amendments No. 1 notified in Army Order 40 of 1928).—*Delete* first two lines and *substitute* :—

" A detailed inspection of respirators will be carried out annually under unit arrangements by an officer or N.C.O. who has qualified as an instructor at the Chemical Warfare School. He will enter the results of his classification on Army Form G870A—the numbers of serviceable " S " and repairable " R " (by unit) (see Sec. 26) and " D " (i.e. other than the " S " and " R ") being inserted in the appropriate columns ; Army Form G870A will then be rendered to I.O.O. in quadruplicate. Repairs to those classified " R " will be carried out forthwith under unit arrangements as laid down in Sec. **26**." Amdt. 4 May, 1930.

or markings that do not interfere with vision.

iv. Metal valve holder is not damaged and makes a gas-tight joint with the facepiece.

v. Outlet valve is not perished or punctured and is securely attached. By gently pulling the rubber, any punctures or weaknesses are more easily seen.

vi. Corrugated tube is sound and securely attached at both ends. If the container is attached at the wrong angle, the rubber tube may twist or become kinked and the facepiece will not stay on the face properly. Hold the facepiece up by the valve holder, letting the container hang freely in order to see that the container is in the correct position relative to the facepiece.

vii. Training container is without holes or signs of rust. Look for rust on the inlet valve and if damage by wet is suspected, remove the valve and examine

7. To prevent the freezing of the outlet valve of the face-

3. Page 22, Section 22, paragraph 7, line 4.—*After* " match " *insert* :—

" ; with the facepiece, Mark IV, treatment of the outlet valve with glycerine is unnecessary."

inlet valve of the training container is not affected by frost, if kept dry. If moisture has entered and frozen, the valve must be removed, thawed, wiped dry and replaced. Inlet valves must not be treated with glycerine.

23. *Respirator inspection*

1. Page 22, Section 23.—*Delete* paragraph 1 and *substitute* :—

" 1. Respirators will be inspected frequently by the company, &c., officer who will verify that respirators are complete and properly cared for.

2. ~~A detailed inspection of respirators will be carried out at half-yearly intervals by a trained gas instructor.~~ The inspection will be made in the following manner :—"

Paragraph 2, line 1.—*For* " 2 " *substitute* " (*a*) ".

ii. Facepiece material is not perished or torn. Hold up to the light and examine by stretching gently for small holes.

iii. Eyepieces are not damaged and are securely bound to the facepiece. Cracks do not permit the entrance of gas but may interfere with vision. Markings sometimes appear at the edges of the eyepieces, but eyepieces should not be condemned for small cracks or markings that do not interfere with vision.

iv. Metal valve holder is not damaged and makes a gas-tight joint with the facepiece.

v. Outlet valve is not perished or punctured and is securely attached. By gently pulling the rubber, any punctures or weaknesses are more easily seen.

vi. Corrugated tube is sound and securely attached at both ends. If the container is attached at the wrong angle, the rubber tube may twist or become kinked and the facepiece will not stay on the face properly. Hold the facepiece up by the valve holder, letting the container hang freely in order to see that the container is in the correct position relative to the facepiece.

vii. Training container is without holes or signs of rust. Look for rust on the inlet valve and if damage by wet is suspected, remove the valve and examine

7. To prevent the freezing of the outlet valve of the facepiece, Mark III, during severe frost, two or three drops of glycerine should be inserted through the slits at the external end of the valve, by means of a match. Half a pint of glycerine should be sufficient for 1,000 respirators. The inlet valve of the training container is not affected by frost, if kept dry. If moisture has entered and frozen, the valve must be removed, thawed, wiped dry and replaced. Inlet valves must not be treated with glycerine.

23. *Respirator inspection*

1. Respirators will be inspected frequently by the company, &c., officer, and at least twice yearly by a trained gas instructor.

(a) The "slung position" is the most convenient for carrying out the inspection. The facepiece and container will be removed from the haversack for inspection and the parts examined to see that the:—

i. Elastic bands are sound and that buckles, tags and loops are firmly attached.

ii. Facepiece material is not perished or torn. Hold up to the light and examine by stretching gently for small holes.

iii. Eyepieces are not damaged and are securely bound to the facepiece. Cracks do not permit the entrance of gas but may interfere with vision. Markings sometimes appear at the edges of the eyepieces, but eyepieces should not be condemned for small cracks or markings that do not interfere with vision.

iv. Metal valve holder is not damaged and makes a gas-tight joint with the facepiece.

v. Outlet valve is not perished or punctured and is securely attached. By gently pulling the rubber, any punctures or weaknesses are more easily seen.

vi. Corrugated tube is sound and securely attached at both ends. If the container is attached at the wrong angle, the rubber tube may twist or become kinked and the facepiece will not stay on the face properly. Hold the facepiece up by the valve holder, letting the container hang freely in order to see that the container is in the correct position relative to the facepiece.

vii. Training container is without holes or signs of rust. Look for rust on the inlet valve and if damage by wet is suspected, remove the valve and examine

2. Page 23, line 5.—*For* " 3 " *substitute* " (*b*) ".
Line 21.—*For* " 4 " *substitute* " (*c*) ".
Line 28.—*For* " 5 " *substitute* " (*d*) ".

t the neck of
the container is securely attached to the body.

viii. Inlet valve is in position and is not perished; the valve seating may be removed with a coin, if necessary.

(*b*) 3. The valves should next be tested.
First adjust the respirator.

Inlet valve.—Close the outlet valve by pinching while the facepiece is adjusted and attempt to breathe out. If air escapes, it is a sign of a defective inlet valve or of a leak in the corrugated tube or the container. Defective inlet valves may often be made good by reversing the rubber disc.

It is always possible to force the air to escape between the edge of the facepiece and the face, but a defective inlet valve will allow air to escape before this lifting of the facepiece occurs.

Outlet valve.—Close the corrugated tube by pinching it and test for leakage by attempting to inhale. See that it is possible to breathe out through the valve. If the outlet valve is stuck owing to saliva drying upon it, this can be remedied by rubbing the valve gently between the thumb and fingers.

(*c*) 4. Examine the haversack, to see that there are no holes in the canvas and that it is complete with sling, brass stud, leather tab, press buttons, whipcord, "Ds." and metal platform. (The metal platform is not required for the service container). See that the anti-dimming outfit is present, and the composition is not exhausted. Check name or army number on haversack and facepiece.

(*d*) 5. Care must be taken to replace the container in the haver-

3. Page 23, Section 23.—*Add* new paragraph :—

4. Page 23, Section 23, paragraph 3 (as promulgated by Amendments No. 1 notified in Army Order 40 of 1928).—*Delete* and *substitute* :—

" 3. All respirators on unit charge which have been classified under unit arrangements as " D ", and 5 per cent. of those as " S " on Army Form G870A will be inspected and sentenced annually by I.O.Os. as laid down in Pamphlet No. 26 R.A.O.S. Part II. Those sentenced " R " (by R.A.O.C.) will be sent to R.A.O.C. for repair on Army Form G1045 ; those sentenced " B.L.R." will be returned to R.A.O.C. and written off unit charge." Amdt. 4 May, 1930.

" 4. In tropical climates :— Amdt. 4 May, 1930.

i. During the monsoon period, facepieces should be frequently wiped and inspected before being put away.

ii. Respirators should be tested in a gas chamber at changes of season (*see* Appendix III).

iii. A monthly " airing " of respirators in store should take place."

the interior of the container. See that the neck of the container is securely attached to the body.

viii. Inlet valve is in position and is not perished; the valve seating may be removed with a coin, if necessary.

(b) 8. The valves should next be tested.

First adjust the respirator.

Inlet valve.—Close the outlet valve by pinching while the facepiece is adjusted and attempt to breathe out. If air escapes, it is a sign of a defective inlet valve or of a leak in the corrugated tube or the container. Defective inlet valves may often be made good by reversing the rubber disc.

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Outlet valve.—Close the corrugated tube by pinching it and test for leakage by attempting to inhale. See that it is possible to breathe out through the valve. If the outlet valve is stuck owing to saliva drying upon it, this can be remedied by rubbing the valve gently between the thumb and fingers.

(c) 9. Examine the haversack, to see that there are no holes in the canvas and that it is complete with sling, brass stud, leather tab, press buttons, whipcord, "Ds." and metal platform. (The metal platform is not required for the service container). See that the anti-dimming outfit is present, and the composition is not exhausted. Check name or army number on haversack and facepiece.

(d) 10. Care must be taken to replace the container in the haversack the right way, so that the facepiece can be adjusted without twisting the tube. After an inspection, men should be ordered to adjust respirators, so that it can be seen whether all containers have been correctly replaced.

3. See attached. 4. See attached.

24. *Fitting respirators with facepieces, Mark III*

The respirator is an article of personal equipment which remains in the possession of the individual throughout his service. In order that the facepiece may provide efficient protection against gas and, at the same time, not lead to discomfort when worn for long periods, it is essential that it should be properly fitted [illegible]

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Amdt. 4
May, 1930.

"4. In tropical climates :—

i. During the monsoon period, facepieces should be frequently wiped and inspected before being put away.

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Outlet valve.—Close the corrugated tube by pinching it and test for leakage by attempting to inhale. See that it is possible to breathe out through the valve. If the outlet valve is stuck owing to saliva drying upon it, this can be remedied by rubbing the valve gently between the thumb and fingers.

(c) 9. Examine the haversack, to see that there are no holes in the canvas and that it is complete with sling, brass stud, leather tab, press buttons, whipcord, "Ds." and metal platform. (The metal platform is not required for the service container). See that the anti-dimming outfit is present, and the composition is not exhausted. Check name or army number on haversack and facepiece.

(d) 10. Care must be taken to replace the container in the haversack the right way, so that the facepiece can be adjusted without twisting the tube. After an inspection, men should be ordered to adjust respirators, so that it can be seen whether all containers have been correctly replaced.

3. See attached. 4. See attached.

24. *Fitting respirators with facepieces, Mark III*

The respirator is an article of personal equipment which remains in the possession of the individual throughout his service. In order that the facepiece may provide efficient protection against gas and, at the same time, not lead to discomfort when worn for long periods, it is essential that it should be properly fitted to the individual. The man when trained to put it on correctly, can then rely for complete protection on that facepiece and that one only. The facepiece and the adjustment of the elastic buckles should therefore not be changed without refitting.

Full details regarding fitting will be found in Appendix III.

25. *Marking respirators*

As soon as men have been fitted with respirators, arrangements should be made to have the latter marked in accordance with para 350, Equipment Regulations, Part I, 1923.

2. Page 24. Section 26, paragraph 1.—*Delete* from ", or" in line 5 to "replaced." in line 6 and *substitute* :—

"will be sentenced "D" by the unit and appropriate action taken." Amd Feb.

4. Page 24, Section 26, paragraph 1.—*After* line 4 *insert* :—

" iii. Changing the inlet valve of the training container, Marks II and III ". Amdt. 1 March, 192

Paragraph 2.—*Add* at end :—

" Wherever a head harness has been changed the 'fit' of the respirator must be confirmed by a gas chamber test." Amdt. 1 March, 192

ends of the elastics into the tags.

3. When a defective container is removed, great care must be taken to avoid damaging the corrugated tube.

Remove the plaster protection on the twisted ends of the wire and turn up the twisted end at right angles to the tube. Press one point of the container detaching tool under a single strand of wire near the twisted end. On pressing over the tool, the wire will be cut by the sharp edge inside the "V". Remove the wire. Insert both points of the "V" under the rubber, then, with the handle of the tool at right angles to the tube, move the tool round the neck of the container to loosen the rubber from the metal. On continuing with an upward movement, the tube will be detached.

4. **Remove the plug of cotton waste** from the neck of the new container, moisten the neck and slip the corrugated rubber tube on it so that the tubing reaches over the flange in the neck and as far down as possible. Care must be taken that the facepiece is in the correct position relative to the container.

The container should then be wired on in the following manner. A piece of binding wire (tinned iron wire, 18 S.W.G.), eleven inches long is passed twice round the rubber tube just below the ridge on the container neck, that is, between the ridge and the top of the container. The ends of the wire are then twisted together with the fingers and the twists gripped with pliers, the wire being tightened by means of a steady pull on the pliers. Without relaxing the pull, twist the wire until the slack is almost, but not quite, taken up. Apply a steady direct pull for the second time and twist

25. *Marking respirators*

As soon as men have been fitted with respirators, arrangements should be made to have the latter marked in accordance with para 350, Equipment Regulations, Part I, 1923.

26. *Repairs to respirators*

1. The following are the only repairs to respirators which are to be carried out by units:—

i. Changing the head harness.
ii. Changing the container.
iii. See attached.

Respirators requiring further repairs, ~~or which have become unserviceable for any reason, should be replaced~~. See attached

2. To change the head harness, the defective harness should be removed from the facepiece, leaving only the buckles which are fixed to the facepiece edges. A new complete set of harness should be attached to the facepiece by threading the elastics correctly through the buckles and then fixing the ends of the elastics into the tags. See attached.

3. When a defective container is removed, great care must be taken to avoid damaging the corrugated tube.

Remove the plaster protection on the twisted ends of the wire and turn up the twisted end at right angles to the tube. Press one point of the container detaching tool under a single strand of wire near the twisted end. On pressing over the tool, the wire will be cut by the sharp edge inside the "V". Remove the wire. Insert both points of the "V" under the rubber, then, with the handle of the tool at right angles to the tube, move the tool round the neck of the container to loosen the rubber from the metal. On continuing with an upward movement, the tube will be detached.

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the wire to take up all the slack. The turns of wire should be firmly embedded in the rubber tube. The twisted end should now be cut off to about ¼-inch length and turned down at right angles, so as to lie flat along the rubber, pointing towards the container. A small piece of adhesive tape, if available, may be placed over the ends of the wire and pressed down until it adheres. This will protect the facepiece from abrasion by the sharp ends of wire. Wiring should be carried out with the maximum tension that can be obtained with a direct pull without over-straining. Attempts to tighten up by twisting the wire instead of by a direct pull invariably cause overstrain at the points where the twist begins, and frequently result in a broken wire, even though the actual tension on the wire is quite low.

5. As an emergency method, when binding wire is not available, the new container may be bound on with string.

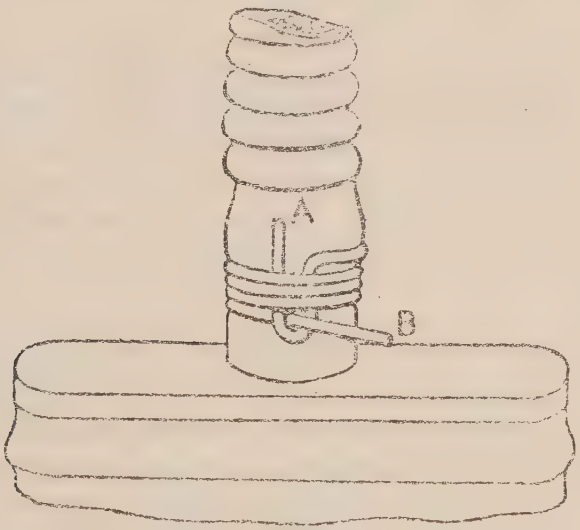

Fig. 1

Rub the string with beeswax or cobblers' wax, if available. Make a loop at one end of the string, "A". Lay it along the tube and parallel to it. Wind the remainder of the string

Page 25, Section 26.—*Add* new paragraphs :—

"5A. To change the inlet valve of the training container, first remove the valve seating from the base of the container with a coin, then slip off the brass retaining pin from the stud on the back of the seating on which the valve is mounted. The valve can then be lifted off the stud. When fitting a new valve it is important that it should be pressed down to the base of the stud before replacing the brass retaining pin. If necessary, the ends of the retaining pin should be lightly closed with the fingers in

Amdt. 1 March, 1923

4. Page 25, Section 26, paragraph 7 (Amendment No. 1).—*Add* :—

"For instructions regarding the use of gas chambers, *see* Appendix III, paragraph 11."

Amdt. 2. Jan. 1929.

the wire to take up all the slack. The turns of wire should be firmly embedded in the rubber tube. The twisted end should now be cut off to about ¼-inch length and turned down at right angles, so as to lie flat along the rubber, pointing towards the container. A small piece of adhesive tape, if available, may be placed over the ends of the wire and pressed down until it adheres. This will protect the facepiece from abrasion by the sharp ends of wire. Wiring should be carried out with the maximum tension that can be obtained with a direct pull without over-straining. Attempts to tighten up by twisting the wire instead of by a direct pull invariably cause overstrain at the points where the twist begins, and frequently result in a broken wire, even though the actual tension on the wire is quite low.

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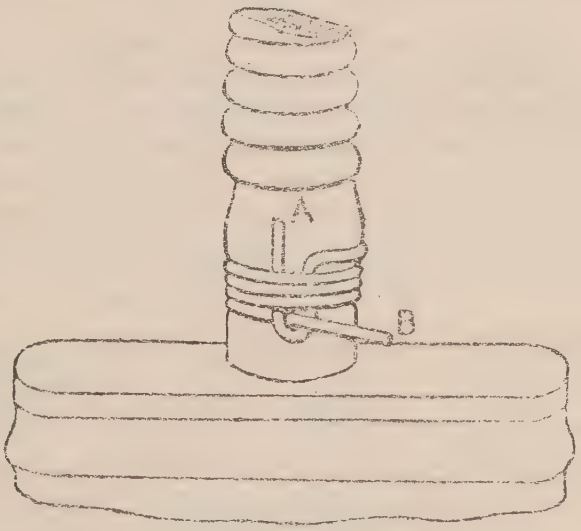

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"7. All respirators in possession of troops will be tested in the gas chamber at least once a year under the supervision of a trained gas instructor." See attached.

the wire to take up all the slack. The turns of wire should be firmly embedded in the rubber tube. The twisted end should now be cut off to about ¼-inch length and turned down at right angles, so as to lie flat along the rubber, pointing towards the container. A small piece of adhesive tape, if available, may be placed over the ends of the wire and pressed down until it adheres. This will protect the facepiece from abrasion by the sharp ends of wire. Wiring should be carried out with the maximum tension that can be obtained with a direct pull without over-straining. Attempts to tighten up by twisting the wire instead of by a direct pull invariably cause overstrain at the points where the twist begins, and frequently result in a broken wire, even though the actual tension on the wire is quite low.

5. As an emergency method, when binding wire is not available, the new container may be bound on with string.

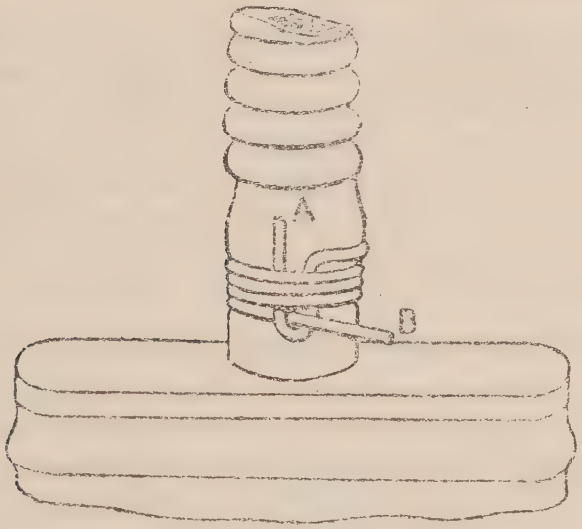

Fig. 1

Rub the string with beeswax or cobblers' wax, if available. Make a loop at one end of the string, "A". Lay it along the tube and parallel to it. Wind the remainder of the string tightly round the tubing at least four times; this holds the loop in position. Pass the end of the string "B" through the loop and fix it by pulling the loop tight from "A". Tie "A" and "B" together with a reef knot. The string binding must be below the ridge in the neck of the container. Test the junction to see that it is secure.

5 A See attached.

6. During operations, to prevent delay in the replacement of defective respirators or containers, small reserves of both will be maintained by units.

7 See attached.

27. *Hygiene of the respirator*

1. Respirators will be disinfected twice yearly and on every

6. Page 26, Section 27, paragraph 1.—*Add* at end :—

" After disinfection and before being put away, respirators will invariably be inspected." Amdt. May, 19

2. Page 26. Section 27.

Delete paragraph 2 and *substitute* :—

" 2. After use the facepiece will be wiped with a clean and dry disinfecting cloth to remove all moisture. In order to keep the facepiece in a wholesome condition, it will be cleaned at intervals to be fixed at the discretion of the company, etc., commander, with a solution of 1 part of Izal in 200 parts of water." Amdt. 6 Sept., 1931

Delete paragraph 3.

the afternoon of the same day, the facepiece should be cleaned after the afternoon parade only.

4. Under certain conditions some discomfort will be caused by the accumulation of condensed breath and perspiration around the chin and inside the facepiece. This condition will increase rather than diminish the protection afforded by the facepiece, but the moisture can be removed by bending forward until the wearer is looking vertically downwards. The liquid will flow into the expiratory vent and can be blown out through the outlet valve.

28. *Protective clothing and anti-gas gloves*

Special clothing to protect the skin against blistering agents, such as mustard gas, will be issued when necessary.

Anti-gas gloves will also be issued to men carrying out decontamination work against mustard gas and for the handling of shell and other materials contaminated with this gas.

27. *Hygiene of the respirator*

1. Respirators will be disinfected twice yearly and on every occasion when the facepiece changes ownership, or in case of infectious disease, in accordance with para. 394, Equipment Regulations, Part I, 1923. See attached.

2. In order to maintain the facepiece condition it will be cleaned after use with a of Izal to 200 parts of water. The whole c facepiece will be sponged with a disinfect this solution and subsequently washed with to dry. Facepieces should not be exposed great heat for drying purposes, since both of the rubber.

3. When respirators are worn in the mo the afternoon of the same day, the facepiece should be cleaned after the afternoon parade only.

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CHAPTER IV

COLLECTIVE PROTECTION

29. *Definition of collective protection*

Collective protection includes all precautionary measures for protecting groups of men, equipment, stores and food against gas. It can best be considered under the following heads:—

i. Warning of gas attacks, that is the recognition of different types of gas attack, weather conditions suitable for them and the actual detection of the presence of gas.

ii. Arrangements for giving the gas alarm and for defensive zones.

iii. Protection of shelters, dug-outs, and cellars, and their ventilation.

iv. Destruction of poisonous substances and their removal from confined spaces.

v. Cleansing of contaminated individuals, clothing and equipment.

vi. Protection of weapons, ammunition, &c.

vii. Precautions with reference to food and water.

These are discussed in the following sections.

30. *Warning of gas attacks*

1. Troops must keep a special lookout for gas when the weather conditions are favourable for its use. (Sec. 3). Unfavourable conditions, however, do not give immunity from gas attacks, which may occur at any time and place.

2. In addition to favourable conditions of weather and ground, there may be other indications that a gas attack is likely to occur. The installation of special chemical weapons, such as cylinders, projectors, &c., requires a considerable amount of labour. Any increased activity within the enemy's lines should therefore be carefully watched. (Chap. II.) A good lookout will generally detect a gas attack before its full strength is developed, so that if the alarm is given quickly, troops should have time to put on respirators.

3. All gases hitherto used in war have either a distinctive smell or an immediate irritant effect on the eyes, nose or throat, so that the presence of gas can always be detected. When conditions permit, troops should be trained to recognize the odours and effects of the principal gases which may be used by an enemy.

31. *Arrangements for giving the alarm and for defensive zones*

1. Serious casualties may occur if prompt warning of a gas attack is not given. The need for quickness in giving the alarm is imperative, particularly in the case of a projector attack, when a delay of a few seconds may result in sleeping men being exposed to a fatal concentration. Speed without flurry is essential. It is the duty of all sentries to be on the lookout for gas and to give warning of its presence or approach. At the same time it is most important that they should guard against the danger of giving false alarms.

2. Two different and distinctive gas alarms are necessary, one, a general alarm, for giving warning of the approach of a gas cloud over an extensive area; the other, a local alarm, for use in attacks such as those made by means of artillery shells or mortar bombs, in which only the neighbourhood of the bursting shell, &c., is affected.

3. No device requiring the use of the lungs should be used as a gas alarm; otherwise, a sentry cannot adjust his own respirator or, if he puts on his own respirator first, he cannot sound the alarm and warn others. No signal that is likely to be mistaken for something else, such as a fire alarm or an "S.O.S.", should be used as a gas warning. Rocket signals are unsuitable for gas alarms; they are uncertain in action, frequently difficult to ignite at the moment they are wanted and, as they do not last more than a few seconds, can only be seen if a sentry happens to be looking in the right direction.

4. For cloud attacks which may be either gas or poisonous smoke, compressed air syrens such as the "Strombos Horn" have proved the most effective devices. The general alarm may also be sent out by all normal methods of inter-communication, such as telephones and wireless.

5. The standard alarm for use in gas shell and projector attacks is the wooden anti-gas rattle which is issued to all units. Local alarms can be improvised from shell cases, steel rails, &c.

6. Notice boards, distinguishing flags or other conventional signs will be erected at the entrances to areas infected by persistent gases, and traffic control police will be instructed to warn troops if certain areas are dangerous.

7. Under certain conditions it may be necessary to define zones as "alert" zones, where the risks of sudden gas attacks are considerable and in which all troops must carry respirators in the "alert" position. The increased range of aircraft makes it necessary for troops to carry their respirators at all times.

32. *Gas-proof shelters*

1. The provision of gas-proof shelters is, in many cases, of vital importance. When troops have to occupy ground contaminated with persistent gas, respirators must be worn continuously, and gas-proof shelters are the only places where men may safely obtain food and drink.

The provision of efficient gas-proof shelters is particularly necessary for headquarters, signal centres, aid posts, and dressing stations, and for all places where it is necessary to carry on work during a gas attack, if possible, without wearing respirators.

2. In mobile warfare, it will usually be impracticable to provide gas-proof shelters in large numbers. If heavy gas attacks are anticipated, it will be advisable to prepare one or two such shelters at such places as headquarters, dressing stations, and at convenient points for use by parties of men in turn for meals.

3. A room with sound walls, roof and floor can easily be made reasonably gas-tight. All windows, if not close fitting, should be puttied up and all other openings blocked up. The doors should be provided with cloth jambs to stop any leakage of air. Fires and other means of heating must be extinguished when the room is used for gas protection, and chimneys stopped up.

4. Dug-outs and shelters can be protected by fixing up special curtains or trap doors covered with blanket or "Cloth, Union, Anti-Gas," a special material supplied for the purpose (Sec. **66**, Manual of Field Works (All Arms), 1925, and para. **191**, Manual of the Medical Aspects of Chemical Warfare, 1926).

5. The following is the correct method of entering a gas-proof shelter. Stand facing the door and catch hold of the bottom slat of the curtain at one corner. Raise the curtain letting it hinge on the opposite end of the slat until the opening is large enough to permit a man to enter in a crouching position, sideways, and adjust the curtain again from the inside. When entering a protected shelter provided with two doors and an air lock, great care must be taken to ensure that one curtain is properly closed before the other is raised. The right or left side of the curtain should be raised in

accordance with the wind direction, so that gas will not be blown directly into the shelter.

6. When a gas alarm is given, the following general precautions should be taken in an occupied building or other shelter:—

i. All windows and doors should be closed and rendered as gas-proof as circumstances permit.

ii. Fires should be extinguished.

iii. Ventilators should be plugged.

7. A supply of any gas-destroying chemicals available should be kept in protected shelters and, in the case of mustard gas attacks, a layer of bleaching powder should be placed on the ground at the entrance to assist in the destruction of the poisonous substance on the men's boots.

Gas sentries should be posted over dug-outs to warn any men who may be asleep in them and to see that the anti-gas curtains are at once adjusted. These sentries will regulate the passage of men in and out of the shelters.

8. When men who have been in a gassed area enter a gas-proof shelter, they nearly always carry traces of gas on their clothing, particularly persistent gases on their boots. Even though steps may be taken to destroy the gas on the boots, there is the danger that the amount carried in on their clothing may cause serious trouble inside the shelter in cases where men are continually entering and leaving such as in a head-quarters or a dressing station. The best method of guarding against this is to construct a shelter with two compartments, the second entered through the first with a set of gas-proof doors between them. Those who are to remain permanently in the shelter stay in the second compartment and nobody who has been going in or out of the shelter should normally enter the second compartment without removing his outer clothing in the first compartment. In the absence of a double compartment system, the outer clothing should be removed in the air lock between the two blanket doors of the single compartment system.

9. In locating gas-proof shelters, advantage should be taken of any natural protection from direct shell burst. Ground has a great effect upon the movement of a gas cloud, especially in a wind of low velocity. Deep hollows and valleys deflect gas from the general direction of the wind. Often such protection can be secured that there is little likelihood of a large amount of gas remaining in the neighbourhood of the shelter.

10. During use, ventilation is not ordinarily provided for gas-proof shelters but, in special cases, ventilation may be

supplied through a gas filtering apparatus on the lines of a large respirator. The length of time a gas-proof shelter may be occupied without ventilation depends on many factors, such as size of the shelter, number of people, temperature of the outside air, etc., but may be expected to be at least several hours. If the discomfort becomes great owing to the heat or to difficulty in breathing, the shelter should be evacuated.

33. *Destruction of poisonous substances and their removal from confined spaces*

1. After a gas attack, gas will remain in unprotected dug-outs and in hollows in the ground, while the craters of gas shell will be contaminated if persistent gases have been used. The craters and any materials or areas contaminated with the persistent liquid will give off gas for prolonged periods and will thus infect air in the neighbourhood.

2. In shallow unprotected dug-outs and trenches, empty sandbags and ground sheets used as fans easily produce sufficient draught to clear the gas. In deeper dug-outs the best way is by means of a fire, the position of which depends on the shape of the dug-out. Normally, it should be placed in the centre, except in the case of a deep dug-out with a long passage leading down to it. In this case the fire should be placed in the passage-way about one-third of the distance from the bottom. The object of the fire is simply to produce a draught to blow away the foul air. The ventilation of dug-outs after a gas attack should not be commenced until the air outside is clear of gas.

3. In the case of shell craters contaminated with persistent gas, the greatest danger will arise from substances of the mustard gas type. Persistent tear gases will be least dangerous. All shell holes contaminated with persistent gases in the immediate vicinity of important posts should be covered with a layer of earth at least 3 inches thick, to prevent further evaporation of the gas. In the case of mustard gas, bleaching powder (chloride of lime) should be used with the earth, if available (Sec. **41**).

34. *Cleansing of contaminated individuals, clothing and equipment*

The need for the cleansing of contaminated individuals, clothing and equipment after a gas attack is greatest in the case of substances which attack the skin, such as mustard gas. The best methods of dealing with this are described in Chap. V. In the case of clothing or equipment contaminated with

other gases, it should be thoroughly aired until the gas can no longer be detected on it.

35. *Protection of weapons, ammunition, &c.*

1. Certain gases have a corrosive action on metals which is intensive if there is any moisture present. Whenever possible, materials should be protected during a gas attack by storing in a shelter, preferably gas-proof. To avoid corrosion of the metal, the following precautions should be taken when practicable:—

i. The metal surfaces should be covered with mineral jelly if attacks are anticipated.

ii. They should be cleaned and re-oiled after an attack.

Rifles, machine guns and other weapons should be fired at intervals during a gas cloud attack. After an attack, all unprotected materials should be thoroughly washed with soap and water, polished with a dry rag, and finally all the metal parts should be oiled.

2. In the case of contamination with persistent gas, weapons will require cleaning to render them safe to use. The main risk is with substances of the mustard gas type, and the best methods to use are described in Chap. V. For other types, cleaning with rags or cloths is probably the quickest and simplest. All rags and cloths used in cleaning weapons, etc., should be buried or preferably burned after use.

36. *Precautions with reference to food and water*

1. Normally all food and water should be kept covered. Any food which possesses a peculiar taste or odour after a gas attack should be destroyed.

2. Water from shell craters should not be used for any purpose whatsoever, as even the boiling of the water may not remove all traces of the poisonous substance.

37. *Tactical protection*

1. Tactical protection consists in the distribution and movement of troops in order to avoid the action of gas. This involves selection of ground, having regard to the fact that gas collects and remains longer in valleys and woods than on high ground and open spaces. In threatened zones the number of troops will be reduced to a minimum. If an area becomes contaminated with mustard gas, the commander will consider whether he can evacuate the area or withdraw a portion of the defenders.

2. The object to be kept in view as regards tactical protection is to expose the minimum number of men and to keep reserves intact.

CHAPTER V

SPECIAL MEASURES NECESSARY FOR PROTECTION AGAINST BLISTERING AGENTS

38. *General*

1. Blistering agents, of which mustard gas is the most important, attack all parts of the body and not only the eyes and lungs, so that special measures of defence are required.

2. These measures are both individual and collective.

39. *Individual protective measures*

1. The smell of mustard gas resembles that of mustard or garlic. If a mustard gas attack is anticipated, all ranks will be warned to adjust respirators immediately it is smelt and not to remove them without orders. All ranks must avoid handling objects which may be contaminated with mustard gas and so spreading the contamination. If possible, troops should be prevented from crossing ground contaminated with mustard gas and from going into contaminated buildings or shelters.

If it is essential for tactical reasons to cross contaminated ground, the following precautions will diminish or possibly entirely prevent casualties.

i. The vicinity of shell holes should be avoided and no one should be allowed to sit or crawl on the ground.

ii. Sandbags, or other covering, may be tied over the boots and then discarded when the contaminated area has been crossed.

A commander's judgment as to avoiding or evacuating contaminated areas will enable him materially to diminish casualties. Contamination may last for days, depending on the weather conditions.

2. Special vigilance is necessary at sunrise following a night bombardment and, in general, during the hot part of the day.

3. Men employed in the decontamination of buildings, shelters, ground, or other objects which have been bespattered with mustard liquid, will be provided as far as possible with protective clothing, including gloves.

4. Personnel who have to remove the clothing of contaminated individuals will also be provided with gloves, and, if necessary, with protective clothing.

5. As the wearing of complete protective clothing is very fatiguing, spells of work in it should be limited to half an hour, after which the individual should rest before recommencing work.

6. Men who have traversed contaminated ground should clean their boots, either by washing with water, or, better still, by brushing them over with bleaching powder (chloride of lime) before entering a building or other shelter. If boots are grossly contaminated by mustard, the liquid or vapour may penetrate and blister the feet.

40. *Collective protection*

1. The best method of protection is to avoid all localities, buildings, &c., known to be, or suspected of being, contaminated by mustard gas. Places known to be contaminated will therefore be plainly marked. (Sec. **31**, 6).

2. In forward areas it will not always be possible to adopt all the measures detailed below for decontamination as the necessary facilities are not likely to be available. Moreover, in many cases elaborate measures will not be necessary. All ranks should, however, be familiar with the means of getting rid of gas. The decision as to what should be done to ensure a reasonable degree of safety must rest with the commander on the spot.

3. Special arrangements will normally be made for the cleansing of clothing and equipment, for the supply of fresh clothing where necessary, and for any extensive decontamination. All ranks should, however, be able to carry out such decontamination as is feasible with local resources.

4. Methods by which:—

i. Earth and grass land,
ii. Roads,
iii. Wooden floors,
iv. Concrete floors,
v. Walls,
vi. Steel and iron work,
vii. Guns, machinery, instruments and tools,
viii. Clothing and equipment,
ix. Boots,
x. Protective clothing,

may be decontaminated, are given in Sec. **41**.

5. The materials suitable are:—

Dry earth.
Sawdust.
Sand.
Water.
Bleaching powder (chloride of lime).
Sodium hypochlorite solution.
"Green solution".

6. *Bleaching powder.*—Chloride of lime is a white powder. It must be kept dry and preferably in air-tight and light-proof containers instead of in ordinary glass bottles. The containers should be stored in a cool place. If made of metal they should be inspected frequently to ensure that they are not rusting. On exposure to the air, bleaching powder rapidly loses its efficiency. It is used both as a powder and also mixed with water.

To mix it with water, place some powder in a bucket, add water and stir the mixture until it forms a thin paste, then add about as much water again, stir the liquid, and it is ready for use. It does not keep well after being mixed with water and should be quickly used.

This solution can be employed if hypochlorite or "Green solution" is not available. Bleaching powder may be the only chemical available in the field for decontamination and supplies of it will probably be limited.

7. *Sodium hypochlorite solution.*—The yellowish sodium hypochlorite solution which is supplied commercially is more efficient for destroying mustard gas when mixed with bicarbonate of soda. The mixture has a greenish tint and is known as "Green solution". It is best made by adding 1-lb. of solid bicarbonate of soda to each gallon of commercial sodium hypochlorite. The mixture should be well stirred. It should be prepared fresh when required as it does not keep well.

8. *Water.*—Water destroys mustard gas slowly. Hot water does so more rapidly.

41. *Methods of decontamination*

1. *Earth and grass land.*—

i. Contaminated ground will give off dangerous vapour and contact with it will produce burns. To prevent this, contaminated ground should be covered with a layer, about 2 inches thick, of a mixture of 1 part of bleaching powder to 2-3 parts of earth, and on top of this a thicker layer—3 to 4 inches—of fresh earth should be placed. Sand, sawdust or soot will

do as well as earth. The ground, when covered, should be left undisturbed as long as possible.

If bleaching powder is not available, the contaminated area should be covered with a layer of earth at least three inches thick.

Where this is not practicable a signboard should be erected showing that the area is contaminated by mustard gas. (Sec. **31**, 6).

ii. Mustard gas liquid and bleaching powder react vigorously together and give off dangerous fumes, sometimes causing fire. For this reason bleaching powder alone should not be put directly on to any heavy contamination by mustard gas liquid but should be mixed with earth.

iii. If long grass is contaminated with mustard gas, it is best to burn it, but care should be taken to stand to windward of the area as dangerous vapour will be given off when the liquid is heated.

2. *Roads.*—Roads can be treated as described in the preceding paragraph, but if water is available they should be swilled or hosed down. Mustard liquid, however, is only destroyed slowly by this method and will remain active, sinking to the bottom of any drains or puddles. Very heavy contamination should be treated with sodium hypochlorite, bleaching powder or Green solution. If subsequently thoroughly washed with water, the area will probably be rendered safe.

3. *Wooden floors*:—

i. A contaminated wood surface should be treated with Green solution (see above). In cases of very heavy contamination, it may be advisable to burn the material rather than to attempt to decontaminate it. If burning is impracticable, the treatment with Green solution should be repeated.

ii. Wooden floors may also be treated by spreading over the affected area a layer of 2 or 3 inches deep of a mixture of 1 part of bleaching powder with 2 or 3 parts of dry earth or sand or sawdust and leaving for 24 hours. This method is less satisfactory than (i).

4. *Concrete floors.*—In dealing with concrete floors, care should be taken not to spread the contamination. Concrete floors may be either:—

i. Hosed or washed down with water and then covered with a solution of water glass (sodium silicate) made up to the consistency of cream,

or,

if the contaminated area is small, or water is not available in quantity,

ii. Covered with a mixture of earth and bleaching powder which should be left on for some hours, after which the area should be covered with water glass as in (i).

5. *Walls.*—Walls can be hosed or washed down with water and then sprayed with a chloride of lime or hypochlorite solution. When hosing or spraying is adopted, adequate drainage is important or the contamination may be spread.

6. *Steel and iron work.*—Steel and iron work should be treated by the methods given for wooden surfaces. A rusty steel or iron surface is more difficult to treat than a clean one and should be given repeated treatments with bleaching powder or Green solution.

7. *Guns, machinery, instruments and tools.*—Mustard liquid dissolves in lubricating oils and greases, and machinery and guns are generally more or less coated with oil and grease. If they are splashed with mustard liquid, the oil on the surface will take it up. As much oil as possible must be rubbed off by swabbing down with mineral naphtha or paraffin, when the oil, in coming away, will bring the dissolved mustard liquid with it. Care should be taken in disposing of the swabs used for the purpose, since they will be grossly contaminated. They should be burned in a fire with a good draught so as to avoid danger from vapour. Detachable portions of the gun or machinery can then be removed and immersed for some time in Green solution. If machinery is not coated with oil or grease, Green solution can be used for decontaminating it, provided that it is remembered that this solution will attack bright steel surfaces slightly if left on for more than three hours. The Green solution can be removed by hosing.

Steel tools are best treated by leaving in Green solution overnight, and then washing in water. As an alternative, they may be immersed for 24 hours in a thin paste of bleaching powder and water.

Instruments or tools upon which bleaching powder itself would have a corrosive action and which boiling water would not injure, can be decontaminated by soaking in methylated spirit, removing and treating with fresh spirit, and finally immersing in water at about 80° C or in boiling water. The contaminated methylated spirit should be disposed of by pouring into boiling water or by burning.

Delicate parts of machinery, &c., may also be cleaned with dry rags, which should be buried or burned after use.

8. *Clothing and equipment.*—All clothing which is known to have been exposed to mustard vapour or liquid should be regarded as dangerous and handled accordingly. Where practicable, it should be collected in an air-tight container such as a bin, and transported to a place where it can be decontaminated. Clothing which has been heavily splashed with mustard liquid, should be destroyed and no attempt made to decontaminate it.

The following are methods of decontamination; that adopted in a particular case will depend largely upon local conditions and facilities:—

i. Exposure in the open air for 2-7 days in summer, or up to 14 days in winter, according to atmospheric conditions and the degree of contamination, will cleanse clothing and equipment which have been exposed to vapour. No garment should be worn as long as mustard gas can be detected on it by smell.

ii. Exposure to a rapid stream of hot air, heated up to the boiling point of water, for three hours, will remove fairly heavy contaminaton.

iii. Immersion in cold running water for 5-30 hours proves effective for moderately heavy contamination. Hot water is more effective and the destruction of mustard gas is hastened by the addition of soap and washing soda (about 2 per cent.) or oil, such as turkey red oil (up to 10 per cent.) Immersion in such a solution for half an hour will cleanse from fairly heavy vapour contamination.

iv. Steeping overnight in hypochlorite solution, diluted about 1 part to 9 parts of water, is effective; but such treatment shortens considerably the life of the garments.

v. Exposing to a current of steam in any of the service disinfectors for 15 minutes *after the steam is really coming off* is a very effective method for cleansing from vapour contamination. If, however, the contamination is heavy, the acid liberated during the destruction of the mustard will damage the fabric.

A rapid method of dealing with the clothes of a number of men who have been exposed to mustard vapour is to put the men, wearing respirators, for five minutes into a chamber containing 1 per cent. chlorine gas. This method should, however, only be carried out under expert supervision. Moreover, the action of the chlorine on the clothing tends to damage the fabric.

Contaminated respirator facepieces may be treated by the above method, or by immersion for two minutes in a dilute

hypochlorite solution (1 part to 9 parts of water), followed by washing in water and drying in the open air. If the face piece has been splashed with mustard liquid, it should be destroyed.

9. *Boots.*—Boots and other leather articles are best treated by brushing thoroughly over with dry bleaching powder, or by exposure to hot air as described above.

10. *Protective clothing.*—If oilskin protective clothing has been contaminated with liquid mustard, it should be hosed down with water to remove as much of the mustard as possible and then placed in boiling water for five minutes, and afterwards hung in the open air for 2 or 3 days. If the clothing is urgently required, the time of immersion in boiling water may be increased to 10 minutes and the subsequent exposure to air reduced to about 12 hours. Longer treatment in boiling water will, however, shorten the life of the garments. If contamination has been considerable or liquid mustard has been in contact with clothing for over half-an-hour, the treatment with boiling water should be repeated. In any case, clothing should not be worn so long as it smells of mustard. In doubtful cases, expert advice should be sought.

Protective clothing can be subjected to such treatment several times, until the oiled surface shows signs of damage.

An alternative method to boiling water is immersion in Green solution for 15 minutes. Afterwards, clothing must be well rinsed and hung in the open air. This method tends to damage clothing, especially the stitching, and should not be repeated more than twice. Careful inspection of articles for faults is necessary after such treatment.

If protective clothing has only been slightly contaminated by vapour, it can be cleansed by hanging in the open air for a day or two, but if there is any doubt, one of the more thorough treatments given above should be applied.

42. *Protection of food supplies*

1. Protection of food is best secured by keeping it in tins or other air-tight receptacles or by covering it completely with tarpaulins or oilskin covers.

2. If air-tight receptacles have been contaminated, they should be cleansed before issue by one of the methods outlined above, e.g. by thorough hosing with water. Contaminated tarpaulins should be similarly cleansed.

43. *Protection against Lewisite*

This is a substance containing arsenic which acts on the body in much the same way as mustard gas. Protection against it is afforded by the measures given above.

CHAPTER VI

PROTECTION OF ANIMALS AGAINST WAR GASES

44. *General considerations*

1. Animals are affected by gas in much the same way as men, but, broadly speaking, the animals used for transport are not so sensitive as human beings.

For instance, a horse will be unaffected by an amount of tear gas which would immediately cause temporary blindness to men. Similarly, the amount of mustard vapour which will just cause burns on a man's skin or affect his eyes will be insufficient to do so in the case of a horse.

2. Nevertheless, casualties will occur amongst animals and it is necessary to take precautions to prevent them.

3. *Eyes.*—If a strong concentration of mustard gas is present, the eyes of a horse should be bandaged.

4. *Washing.*—Horses should not be taken over shell holes or other ground known to be contaminated by mustard gas, if it can be avoided: otherwise, the horse's belly and legs should be washed with water (and soap, if available) as soon as possible. Particular attention should be paid to the heels immediately above the hoof. Care should be taken to avoid touching the contaminated parts with bare hands and protective gloves should be worn, if available.

Mustard burns, when they develop, resemble the injuries caused by rope galls and cracked heels, and may be mistaken for them.

5. *Respirators.*—If gases which affect the lungs are present, a horse respirator may be applied; if this is not available, a nose bag lined with hay slightly moistened with water should be used. Horses, when wearing respirators of any type, should not be made to move faster than a walk and should be given frequent rests to allow them to take breath.

6. Horses in a zone which has been contaminated with mustard gas should be prevented from eating grass or leaves, the simplest method being by means of a nose bag.

7. Horses should be stabled or tethered on high ground rather than in low ground or in woods where gas may collect.

8. The measures given above apply equally to mules and other transport animals.

9. *Pigeons.*—Pigeons are highly susceptible to gases which affect the lungs and when such are present their baskets or cages should be covered with special bags, i.e. "Bags, pigeon, anti-gas", which are an ordnance supply. If for any reasons the birds cannot be protected against the gas, they should be liberated at once.

CHAPTER VII

GENERAL PROCEDURE FOR DEALING WITH GAS ATTACKS

45. *Procedure to meet a gas attack*

1. Although all troops receive routine training in the methods of meeting gas attacks, specific plans and orders dealing with gas defence will be required.

2. As regards the general principles to be considered in the preparation of plans and orders, non-persistent and persistent gases require to be dealt with in slightly different ways. If a non-persistent gas is used by the enemy, all unnecessary movement should cease. Troops in direct contact with the enemy should be prepared to repel a hostile infantry assault. Troops in the rear areas may use gas-proof shelters when available, but sentries should be posted (Sec. **32**, 7).

3. When a persistent gas is used, troops cannot remain in the gassed area for an extended period of time without a considerable loss of morale and of general effectiveness. Therefore, provision should be made for troops to occupy alternative positions, having due regard to the tactical considerations. If the tactical situation demands that the troops do not shift their position, the gassed area should be held as lightly as possible, and provision should be made for frequent relief of the troops thus exposed (Sec. **37**). Such moves should be made only when it has been determined that the enemy is not using the gas merely for harassing purposes, but is actually establishing such a degree of contamination as will cause casualties or render dangerous the occupation of that particular area.

46. *Procedure during a gas attack*

As soon as it has been established that a gas attack is in progress, the alarm should be given by all means available. Respirators should be adjusted, doors closed and fires in gas-proof shelters put out; material should be protected and, in general, all routine measures of individual and collective protection should be carried out. C.Os. will determine, as quickly as possible, the nature and extent of the attack. They must ascertain whether a non-persistent or a persistent gas,

or a mixture of both, is being used, and what parts of their unit are involved. Casualties will be removed from the gassed area as soon as possible and first aid treatment given, if necessary.

47. *Procedure after a gas attack*

The first and most important action to be taken after a gas attack is to make sure that everybody is prepared for another attack. Troops having successfully come through a gas attack are liable to be caught by surprise, and heavy casualties may be inflicted by a subsequent attack some hours later. All routine measures will be carried out according to the standing orders for defence against gas. C.Os. concerned will estimate the purpose of the enemy in making the attack, and will determine whether or not this purpose was realized. They will report on the state of the gas discipline among the units affected by the attack. They will report all facts of interest from an intelligence point of view, and, finally, they will determine the location and extent of areas unfit for occupation owing to the presence of persistent gas and see that arrangements are made to warn troops of these areas. C.Os. should keep themselves informed as to facilities for bathing, and arrange that their commands take advantage of such facilities, whenever necessary. Any special chemicals that may be provided for destroying gas should be used as required.

48. *Standing orders for defence against gas*

These orders apply to all routine measures of individual and collective protection which are independent of the tactical situation, and they prescribe standard methods of carrying out these measures. The following is a list of the most important points and features that should be covered in such standing orders:—

i. The limits of alert zones should be defined and the special protective measures to be observed in these zones should be clearly set out.

ii. Provision should be made for frequent and regular inspection of all material for individual and collective protection.

iii. An efficient alarm system should be maintained.

iv. The normal duties of sentries and subordinate unit commanders should be prescribed.

v. Individual action during a gas attack should be laid down. This should include the adjustment of respirators, spreading of the alarm, awakening of

sleeping men, closing of doors of gas-proof shelters and putting out fires therein, cessation of unnecessary movements, notifying the next in command, &c.

vi. Removal of respirators after a gas attack without authority of a responsible officer or N.C.O. will be forbidden. Entrance into a gassed area, except on duty, should also be forbidden. Shelters should be ventilated after a gas attack.

vii. General precautions to be taken in the presence of persistent agents, particularly those of the mustard gas type, should be prescribed, and arrangements for warning troops of areas dangerous to occupy should be stated.

viii. Parties should be detailed for the purpose of decontaminating infected areas.

ix. The inspection and proper care of all material which has been in a gas attack should be laid down.

x. Food and water should be covered during a gas attack, and any food not so protected, with a peculiar smell or taste after a gas attack, should be destroyed.

xi. Instructions should be given as to first aid treatment and the disposition of gas casualties.

xii. Early report should be made to higher commanders as to the size of the area and the units involved in a gas attack and the type of gas used.

CHAPTER VIII

EFFECTS OF WAR GASES AND THE FIRST AID MEASURES AGAINST THEM

49. *General*

1. Full details regarding the signs, symptoms and treatment of the various forms of poisoning by chemical agents will be found in the Manual on the Medical Aspects of Chemical Warfare (1926).

Brief reference will be made here to certain general facts and first aid measures which should be familiar to all ranks.

2. The necessity for being constantly on the alert before a gas attack and the discomfort of wearing respirators once the attack has been made impose a heavy strain on all but well trained and seasoned troops.

In the case of insufficiently trained men, or of those wearied by the strain of war, large numbers may report sick after a gas attack, thinking that they are gassed, when in reality they have only smelt gas in a harmless concentration. Careful enquiry into each individual case is therefore necessary before a casualty is evacuated.

3. Against all gases which affect the eyes and breathing organs, the respirator is a perfect protection. Men who have inhaled a small dose of gas are apt, owing to the initial discomfort experienced on first putting on their respirators, to think they are being gassed and will be unable to breathe in them. This is a fallacy, and every endeavour must be used to make them continue to wear their respirators, otherwise they will inevitably suffer from further gassing which may prove fatal.

4. The first essential (if circumstances permit) is to remove the affected man at once from the poisonous atmosphere; if this cannot be done immediately, every effort must be made to keep his respirator adjusted to prevent further damage being done.

The respirator affords no protection against carbon monoxide. (Chap. IX.)

Clothes suspected of being contaminated by gas should be removed as quickly as possible to minimize the chances of further injury and of risk to those attending the casualty.

This precaution is particularly important in the case of mustard gas poisoning, but must not be overlooked in the case of other gases. The clothing should not be removed by the man himself, but by someone suitably protected.

5. Success in chemical warfare largely depends upon surprise. An enemy may employ a new substance against which defensive measures are not immediately available. If apparently unusual effects are produced by chemical weapons, gas officers and M.Os. must be informed at once, so that there may be no delay in investigating them, and, if necessary, in formulating new treatments to protect against them.

50. *Tear gases*

1. *Tear gases* cause acute pain in the eyes with a profuse flow of tears and spasm of the eyelids. Removal from the contaminated atmosphere is usually followed by rapid recovery and is all the treatment necessary.

2. In severe cases the pain may be relieved by bathing the eyes with a solution of salt in water (one teaspoonful of common salt in a pint of water).

51. *Lung irritants*

1. *Poisonous smoke.*—The poisonous smokes cause severe pain in the nose, throat and chest, with coughing and sneezing and in some cases vomiting. Removal from the cloud and a few hours' rest will in a large number of cases restore the individual to normal.

Treatment.—Pain may be relieved by the inhalation of chloroform or by washing the mouth and nose with a solution of bicarbonate of soda in water (two teaspoonsful to the pint).

2. *Non-persistent gases.*—A choking sensation with pain in the chest, coughing, nausea, and sometimes vomiting follow immediately on exposure to gases of the type of chlorine, phosgene and chloropicrin. Some of them, e.g., chloropicrin, also cause watering of the eyes. Phosgene gives a peculiar taste when tobacco is smoked.

Treatment.—With gases of this type, which injure the lungs, and also with gases which affect the nervous system, such as prussic acid, it is most important that the affected man should be kept at rest and spared every exertion. In some cases the onset of symptons is delayed and therefore in cases of uncertainty as to whether this type of gas has been encountered, the casualty should be given the benefit of the doubt until medical advice is forthcoming, and should be treated as a stretcher case from the earliest possible moment. The clothing

should be loosened to facilitate the breathing and the patient should be kept warm.

If breathing becomes shallow and gasping and threatens to fail, the only chance of saving life may be to apply artificial respiration and to obtain medical aid as speedily as possible.

52. *Blistering agents or skin irritants*

1. A peculiarity of mustard gas is that persons may be unaware that they have been affected by it until some time after exposure, since there is no immediate feeling of pain or discomfort. (Sec. **4**). Symptoms generally appear in anything from 4 to 12 hours, but may be delayed 24 hours or longer.

Mustard causes injury to any part of the body with which it comes in contact.

2. The eyes become inflamed; there is a profuse flow of tears and spasm of the eyelids, so that the affected person is quite unable to see. The mental effect of this is great, and patients should be assured that the disability is in the great majority of cases only temporary and will, with proper treatment, completely pass away. First aid should be directed to washing the eyes with a solution of salt in water (Sec. **50**).

3. When breathing passages are affected, the first signs are dryness of the throat and a brassy cough. These may be relieved by gargling with a solution of bicarbonate of soda in water (Sec. **51**).

4. In the case of skin burns the first signs are a reddening and swelling of the skin which is frequently accompanied by intense itching. The reddened areas gradually extend and blisters develop. Care should be taken that these are not broken until medical aid can be obtained, as the resulting sores are very liable to infection and heal slowly.

5. In the event of contamination or suspected contamination of the skin with mustard gas or similar liquid, the following procedure should be followed:—

Scrub the part thoroughly with soap and water with a nail brush or pumice stone (except on tender parts of the skin) *for five minutes*, changing the water and rinsing out the brush two or three times during this period. The nail brush (or pumice stone) should be boiled in water after use.

If soap is not available, bleaching powder should be made into a cream, lathered all over the affected part and left on for two or three minutes. At the end of that time, the bleach should be washed off with water.

The treatment should be carried out as soon as possible after contamination. Should delay be unavoidable, the treatment

should still be carried out, as subsequent injury will thereby be diminished.

6. Persons exposed to the vapour of mustard gas should remove their clothing as soon as possible, and bathe from head to foot, using plenty of soap.

The chief things to do are to have any contaminated clothing removed, and to cleanse the affected part from mustard as directed above, without spreading contamination to other parts and without a moment's delay.

53. *Burns from phosphorus*

1. When shell, bombs, or grenades containing phosphorus explode, large lumps of burning phosphorus are scattered over a wide area and may give rise to serious burns, since the phosphorus even though embedded in the flesh will continue to burn so long as air can reach it.

2. First aid measures are therefore directed towards stopping the phosphorus burning and removing it. The wound should be filled with water. Warm water is preferable since phosphorus melts at a temperature of 112° F. and can be removed under water or wiped off with a piece of gauze or a handkerchief. Medical aid should be sought as early as possible.

CHAPTER IX

DANGERS FROM CARBON MONOXIDE

54. *General considerations*

1. Carbon monoxide (the "afterdamp" of colliery explosions) is formed in large quantities by the explosion or burning of explosives, and may therefore result from the burst of H.E. shells or occur in the blow-back from guns and machine guns. It is always formed when combustion takes place in a limited supply of air, e.g., in burning buildings. It also occurs in the exhaust gases of internal combustion engines and in the fumes given off by coke or charcoal braziers. In the open air it is quickly diffused, and the main danger is in confined and badly ventilated spaces.

2. In mining operations, carbon monoxide may be produced in large quantities. The amount depends not only on the type of explosive used, but also upon the quality. Deterioration of the charge or of the detonators, from whatever cause, may lead to incomplete detonation of the charge with the consequent production of large quantities of carbon monoxide. Bad quality of explosive or of detonators, or insufficient or weak detonators may also cause this.

When a mine is exploded, the galleries and shafts are filled with gas. There is less trouble from gas after firing a mine (where a crater is formed) than after a camouflet where the surface of the ground is not broken. The danger of poisoning by the gas may be increased when galleries are driven through ground previously mined, since pockets of gas may occur in disturbed areas.

Sudden rushes of gas into galleries which were free from gas may occur owing to (*a*) sudden settling of the ground from any cause (rain, another blow, &c.) forcing the contained gas into a gallery, or (*b*) change of atmospheric pressure, or (*c*) changes in the water level.

3. After the explosion of an enemy mine, carbon monoxide gas may find its way into neighbouring trenches and may cause casualties if the trenches are very narrow or where weather conditions (absence of wind, heavy dull atmosphere) are unfavourable for rapid dispersion of the fumes in the open. Infantry should be warned against taking shelter in

the mine shafts, dug-outs, chambers, &c., from the shell fire which often accompanies an enemy mine explosion. The dangers from this form of gas poisoning should be borne in mind when occupying and consolidating a position in a crater shortly after a mine has been blown.

4. The gas is odourless and non-irritant, and the onset of symptoms is so insidious that the first warning which a man may receive of danger may be failure in the power of the limbs which will prevent him from withdrawing into safety. Sometimes warning is given by headaches, vertigo or fatigue and if these symptoms occur among the occupants of a dug-out or enclosed space, the presence of the gas should be suspected. When exposed to high concentrations of the gas, loss of consciousness and death are rapid, but with lower concentrations symptoms appear slowly in the following sequence:—loss in power of the limbs, giddiness, confusion of mind, breathlessness and palpitation of the heart on exertion, failure in the intellectual powers, and complete loss of consciousness which may finally end in a painless death.

5. The onset of the symptoms may be rapid and affected persons should be removed from the contaminated atmosphere without delay. If breathing fails, artificial respiration should be resorted to and persevered with until medical aid can be obtained.

Sufferers from this form of poisoning should be spared all unnecessary exertion and should be kept warm.

6. The service respirator does not protect against carbon monoxide gas, and if it is necessary to go into an atmosphere where it is present, a self-contained oxygen breathing apparatus must be worn. The gas can be readily cleared from a confined space by ventilation, and in tanks, &c., where there may be a danger of the gas accumulating in action, arrangements should be made to ensure a good draught of air. Small birds may be used for the purpose of detecting the presence of the gas, as they are affected far more quickly than a man is and therefore serve to give warning of the danger.

CHAPTER X

ANTI-GAS TRAINING

55. *General scheme of training*

1. The respirator is part of the soldier's equipment. Training in defence against gas is the responsibility of the unit commander as is any other form of training.

2. A minimum of one officer and one senior N.C.O. from each unit will be trained as instructors at the Chemical Warfare School at home or at command schools abroad. Refresher courses will be arranged as necessary.

Special short courses are also arranged for senior and staff officers in order that they may be able to supervise the anti-gas training in their commands.

3. C.Os. will arrange for these instructors to hold regimental courses for the training of company officers and N.C.Os. in defence against gas, so that the latter can instruct their own units progressively and concurrently with other forms of training in the unit.

4. An instructor will act as the adviser of the C.O. on gas defence matters. He will be responsible to the C.O. for the fitting of all respirators and for their inspection at regular intervals. He will supervise their half-yearly disinfection. He will be responsible for the inspection and supervision of all gas defensive appliances on charge of the unit.

All gas chamber work will be carried out under the personal supervision of officer instructors.

These instructions do not relieve the C.O. of the responsibility laid upon him in Sec. 7.

5. Officers attending the Chemical Warfare School will be given a detailed syllabus setting out the lines on which training in units should proceed.

56. *General principles of training*

1. The chief consideration in anti-gas training is to develop discipline and practical proficiency in the use of gas defence appliances.

2. The second consideration is to develop confidence in the efficiency of protective appliances. Drill and lectures alone are insufficient, confidence can be gained only by the personal experience of the soldier himself.

3. The third consideration is to give the soldier, by means of lectures and demonstrations, a knowledge of the tactics and special weapons which an enemy will probably employ, so that he may act intelligently if gas is used against him.

4. **In all training schemes and operations the possible use of gas will be taken into consideration.**

57. *Drill*

1. Respirator drill (Appendix I) is to teach the correct handling and the rapid adjustment of the respirator. It should not be carried out by larger units than a platoon, as proper supervision and instruction of large units is difficult.

It is most important that drill should be carried out by night as well as by day. Respirator drill must also be taught when men are sitting and in the lying position for firing.

2. In all stages of training, care should be taken that each movement is accurately performed. When accuracy has been attained, drill may be carried out at gradually increasing speeds until complete adjustment can be automatically performed in the standard time. Respirator drill should never be carried out with the same automatic precision that is required at rifle drill and ceremonial.

When the drill has been mastered, competitive games may be introduced, but speed in adjustment should never be encouraged at the expense of accuracy. As long as a man holds his breath, his lungs cannot be affected by gas, and therefore, the necessity for great speed in putting on a respirator is not vital. Practice in holding the breath is more valuable.

"Holding the breath" does not mean taking a deep breath and holding it, for that might be fatal if gas was present; it means "stop breathing." There is no objection to breathing out a little if the lungs are uncomfortably full, but on no account must a man breathe in, even if his lungs may be uncomfortably empty.

58. *Recruit and individual training*

1. Anti-gas training should be commenced early in the recruit's career and should be spread over a period of not less than four weeks. He should be fitted with and given a respirator soon after the first lecture on the subject of gas defence.

2. For some time, practical work should consist entirely of respirator drill. When proficiency in this has been attained, training may be introduced so that the soldier increases his ability to combine gas defensive measures with his other military duties.

3. Lectures should be given on the various details of gas defence and the recruit should be instructed in such practical measures as the use of gas-proof doors and air locks, clearing shelters and trenches of gas, simple first-aid, disinfecting shell-holes, the use of alarm devices, etc.

4. The final aim of gas training is to enable soldiers of all arms and services to perform their duties efficiently whilst protected from gas.

59. *Collective training*

1. Once they have reached the required standard of individual efficiency, officers and N.C.Os. will be given practice in handling their commands under all conditions that the use of gas is likely to produce.

2. Simple exercises should first be carried out, working gradually up to more complicated schemes. The object of such schemes should not be to practise the wearing of respirators so much as to carry out ordinary manœuvres whilst protected against gas. Confidence will thus be developed and the chances of being surprised by a gas attack will be reduced.

3. Collective training is essentially the duty of regimental officers. No amount of school and squad training can replace training in the field.

4. Suggestions for simple schemes are as follows:—

i. A unit, moving to its assembly position in the dark, is subjected to a sudden gas bombardment.

ii. A unit in similar circumstances discovers contaminated ground in its path.

iii. A unit in billets is suddenly shelled with mustard gas and is compelled to evacuate them.

The unit requires to be handled under shell fire, wearing respirators in the dark. Changes of clothing will be arranged and sentries posted to keep others out of the dangerous area.

iv. A battery is shelled with persistent gas and forced to move to an alternative position. The position will be evacuated and ammunition removed, whilst respirators and gas-proof gloves (if available) are worn.

v. A bridge which has been heavily contaminated with mustard gas has to be crossed and the bridgehead consolidated under fire.

Troops will improvise means of crossing to avoid contamination, while the units in reserve are being shelled with gas.

vi. A demolished bridge and the ground around it are left saturated with persistent gas and the bridge has to be repaired.

5. Exercises without troops will include the consideration of the effects of gas attacks.

Exercises in which men are marked as casualties to be dealt with by medical personnel will always include arrangements for gas casualties. Such casualties will be marked as "Gassed —lung irritant, skin burns," &c., and will be handled and treated accordingly.

60. *Stores for anti-gas training*

Stores issued to units for anti-gas training are laid down in Army Council Instructions 388, 473, 596 and 733 of 1924, and 20, 100, 181, 415 and 557 of 1926.

Additional special stores may be issued in connection with divisional exercises and manœuvres.

APPENDIX I

PRACTICES TO TEACH CORRECT HANDLING AND ADJUSTMENT OF RESPIRATOR WITH FACEPIECE, MARK III

1. *To teach the "slung" position*

Respirator with sling over right shoulder, haversack on left side, with press-buttons closed and next to the body.

2. *To bring the respirator to the "alert" position from the "slung" position*

On the command "*Gas Alert*", place the rifle between the knees. Slip the left arm through the sling of the haversack and bring the latter round so that it hangs in front of the body. Seize the leather tab with right hand, slide the left hand up the sling and grasp the brass button, bring it down and fasten it to the leather tab. Undo the press-buttons. Withdraw the length of whipcord from the right hand compartment, pass it through the "D" on the right of the haversack, carry it round the waist and fasten it to the "D" on the left. The press-buttons will be left undone, but the flap will be tucked between the body and the haversack.

Note.—The haversack may be supported in the "*Alert*" position by the following alternative method:—

The respirator is raised to the chest, and the slack of the sling is allowed to fall down the back. The whipcord is passed through the right hand "D" of the haversack and through the sling behind the back, and fastened to the left hand "D" after adjusting the respirator to the proper height on the chest.

3. *To adjust respirator from the "alert" position*

On the command "*Gas*", if the rifle is not slung, place it between the knees. Place the closed fist of the left hand on the bridge of the nose, and knock the steel helmet forward with right hand, so that it falls and is caught on the left arm by the chin strap. Insert the thumbs between the haversack and the body and open the haversack flap. Seize the facepiece with the right hand, thumb and fingers grasping the valve

holder and as much of the facepiece as possible. Bring the facepiece smartly out of the haversack, hold it in both hands with all fingers outside and thumbs inside pointing upwards under the elastic bands. Bring the facepiece towards the face, dig the chin into it, and bring the elastic bands back with the thumbs over the crown of the head to the correct position so that the middle elastics on either side are approximately horizontal. Run the fingers round the facepiece to make sure that the edges are not folded over, nor the elastic twisted, and correct any fault in adjustment. Replace the steel helmet with the chin strap at the back of the head.

4. *To adjust the respirator from the "slung" position*

On the command "*Gas*", place the rifle between the knees. Slip the left arm through the sling of the haversack and bring the latter round so that it hangs in front of the body. Place the closed fist of the left hand on the bridge of the nose and knock the steel helmet forward so that it falls and is caught on the left arm by the chin strap. Undo the press-buttons and adjust the facepiece as in 3, allowing the haversack to hang by the rubber tube. As soon as protection is obtained, adjust the haversack in the "*Alert*" position.

Note.—In practices 3 and 4, if steel helmets with the spring chin strap are in use, the strap being worn "well under the chin," the drill detail for the helmet may be disregarded. It will be found that the spring strap will allow the helmet to slide on to the back of the head out of the way, if the adjustment of the facepiece is carried out correctly. When adjustment is complete, the helmet should be lifted, not pushed, into position on the head, the strap remaining under the chin throughout the operation.

5. *To test for gas*

Take a deep breath, and insert the fingers of the right hand between the facepiece and the cheek. Sniff gently. If gas is present, remove fingers and breathe out hard.

6. *To remove facepiece*

On the command "*Remove Facepiece*" insert the fingers of the right hand under the facepiece at the chin. At the same time raise the steel helmet slightly with the left hand and remove the facepiece with an upward motion.

7. *To return facepiece to haversack*

After use, fold the facepiece by placing the elastic inside the facepiece and folding in the forehead portion so that it

separates the eyepieces. The facepiece is then to be replaced in the haversack, forehead first, with the harness buckles to the wearer's right. Care should be taken that the connection tube is not twisted in this operation. Tuck the flap of the haversack between the latter and the body, and replace the steel helmet on the head.

8. *Subsequent practices*

All ranks will wear their respirators during other training parades, both by day and by night, so that their efficiency in the performance of all their normal duties is not unduly diminished by wearing the respirator.

9. *Notes for instructors when teaching the respirator drill*

1. In practices 3 and 4, when sufficiently practised, the breath should be held until the facepiece is in position. The facepiece should then be cleared by breathing out hard.

2. Speed should be developed, but not at the expense of accuracy.

3. In practices 3 and 4, when complete adjustment has been obtained, each man will be instructed to take one pace forward and come to attention. This and similar methods cause emulation and increase the speed of the class as a whole.

4. When sufficiently practised in practice 6, men will be instructed to carry out practice 5 on every occasion when permission is given to remove facepieces.

5. The eyepieces should be cleaned once weekly, or after each time the respirator has been worn, as laid down in Sec. **21.**

6. The effective "life" of the facepiece depends upon the care and accuracy with which it is folded and replaced in the haversack.

APPENDIX II

THE METHOD OF CARRYING THE RESPIRATOR BY MOUNTED TROOPS

1. *Alterations to the haversack for use by mounted troops*

The following alterations in the method of carrying the respirator have been authorized for use by mounted troops.

The haversack is altered as follows (Fig. 2) :—

i. Remove the elongated metal ring by which the sling is attached near the leather tab by cutting the loop of webbing which attaches it to the haversack and sew it to the edge of the haversack with the bottom end of the metal loop just above the "D" ring. Remove the metal stud from the sling.

ii. Unstitch the leather tab from the haversack, and sew it on to the under length of the double portion of the sling at a distance of 4 inches from the point of attachment of the ring to the buckle and at an

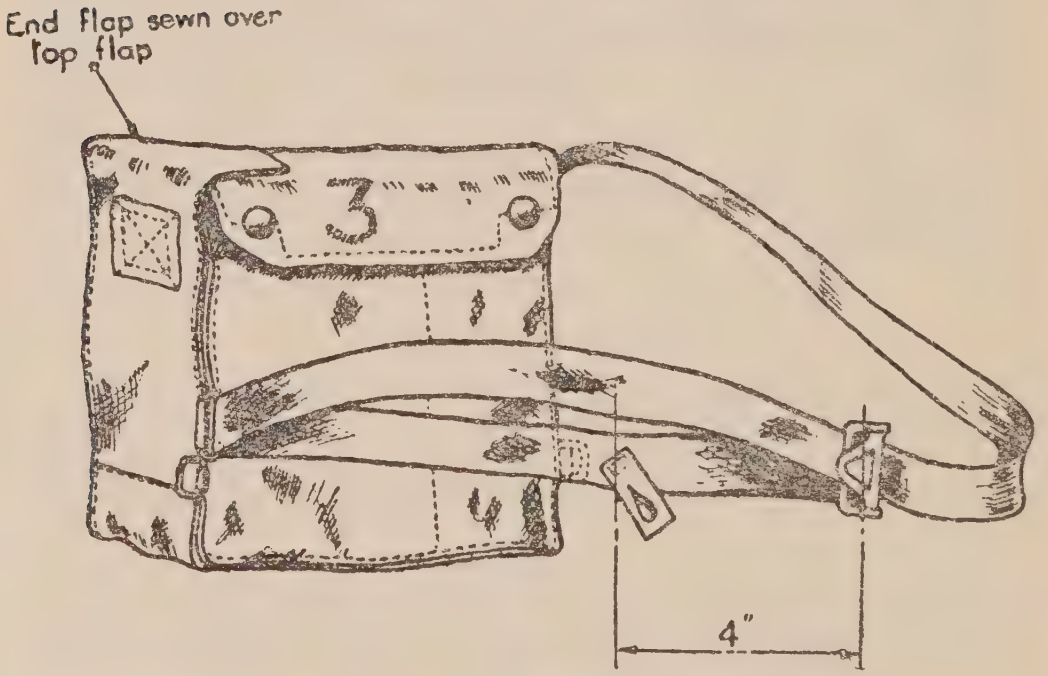

Fig. 2.

angle of 45 degrees to the sling as shown in the sketch.

iii. Unstitch the end flap at the top corner of the haversack from which the sling has been removed and sew it over the top flap. (L. of C. A. 428 and A. 824 issued with A.O. for August, 1924, and April, 1925, respectively).

2. *To carry the respirator*

Put the respirator on in front of the body with the sling over the right shoulder and under the left arm. Unbuckle the bandolier and pass it over the sling behind and *under* the haversack in front. Fasten the bandolier.

Pass the haversack over the right shoulder until it is stopped by the bandolier. Adjust the sling so that the respirator is firmly held at the back of the right shoulder. If the leather tab has been sewn on the sling in the correct position, it can now be buttoned on to the second button of the tunic.

3. *To come to the "alert" position*

Unfasten the leather tab, bring the respirator to the front over the right shoulder and settle squarely in front of the body. If the previous adjustment has been correct, it will now be in the alert position. Secure in place with the whip-cord and proceed as for dismounted arms.

Cavalry working dismounted will continue to carry the respirator described above.

6. Pages 60 and 61, Appendix III, Heading.—*For* line 2 *substitute* " FACEPIECES, MARKS III and IV ".

Paragraph 2, line 1.—*After* " III " *insert* " or Mark IV ".

Paragraph 5—

Line 1.—*For* " over 80 " *substitute* " approximately 90 ".

Lines 2 and 3.—*For* " normal (size 3) facepieces " *substitute* " the normal size facepiece ".

Line 5.—*Before* " determining " *insert* " principal " and *before* " eyepiece " *insert* " position of the ".

Lines 5 and 6.—*For* " rides at a level on the face " *substitute* " is."

Paragraph 6—

Lines 3 and 14.—*For* " straps " *substitute* " elastics ".

Line 11.—*For* " strap or straps " *substitute* " elastic or elastics ".

Line 15.—*After* " loose " *insert* " or the position of the harness is too low on the back of the head ".

Paragraph 7.—*Delete* from " If " in line 1 to " out " in line 2 and *substitute* :—

" When a satisfactory tension and position of the harness has been obtained ". Amdt. 1 March, 192

Line 4.—*For* " buckles " *substitute* " tension of the elastics ".

essential for the full width to be in contact, but the wider the contact the more comfortable will be the fit. The facepiece is so shaped that this contact, which should only be a slight pressure, is obtained automatically and independently of the elastics of the harness, the only function of which is to hold the facepiece up to the face and to carry the weight and pull of the connecting tube. The position of the facepiece on the face is controlled by the fit of the chin into the chin pocket of the facepiece so that the general direction of the pull of the harness should be upwards and backwards from the chin.

3. In order to secure the maximum of comfort during prolonged wear, care must be taken to obtain correct adjustment, size and harness tension. This operation is known as "fitting", and responsibility for fulfilling these three conditions successfully rests upon the fitting officer.

4. *Adjustment.*—(By "adjustment" of the respirator is meant the removal of the facepiece from the haversack and the placing of it in the wearing position on the face.) Correct adjustment of the facepiece is obtained by following the detail of respirator drill. In its final position the facepiece should be square on the face, while the harness is symmetrically positioned on the back of the head.

APPENDIX III

INSTRUCTIONS FOR FITTING RESPIRATORS WITH FACEPIECES, MARKS III & IV.

1. In order that the facepiece may provide efficient protection against gas and, at the same time, not lead to discomfort when worn for long periods, it is essential that it shall be properly fitted in each individual case.

2. The wearer of the respirator, with a facepiece Mark III, breathes in a natural manner through his nose or mouth. In a poisonous atmosphere he is protected because the only air which can reach his face is that which has been purified by passage through the container. All other air is excluded by the specially shaped rubber band which forms the edge of the facepiece. This band is called the fitting surface, and is about 1½-inches wide. Gas tightness is obtained by contact between this fitting surface and the skin which lies over the bony structure of the forehead, cheeks and chin. It is not essential for the full width to be in contact, but the wider the contact the more comfortable will be the fit. The facepiece is so shaped that this contact, which should only be a slight pressure, is obtained automatically and independently of the elastics of the harness, the only function of which is to hold the facepiece up to the face and to carry the weight and pull of the connecting tube. The position of the facepiece on the face is controlled by the fit of the chin into the chin pocket of the facepiece so that the general direction of the pull of the harness should be upwards and backwards from the chin.

3. In order to secure the maximum of comfort during prolonged wear, care must be taken to obtain correct adjustment, size and harness tension. This operation is known as "fitting", and responsibility for fulfilling these three conditions successfully rests upon the fitting officer.

4. *Adjustment.*—(By "adjustment" of the respirator is meant the removal of the facepiece from the haversack and the placing of it in the wearing position on the face.) Correct adjustment of the facepiece is obtained by following the detai. of respirator drill. In its final position the facepiece should be square on the face, while the harness is symmetrically positioned on the back of the head.

By Command of the Army Council,

H. J. Creedy

WAR OFFICE,
21*st March*, 1928.

6. Pages 60 and 61, Appendix III, Heading.—*For* line 2 *substitute* " FACEPIECES, MARKS III and IV ".

Paragraph 2, line 1.—*After* " III " *insert* " or Mark IV ".

Paragraph 5—

Line 1.—*For* " over 80 " *substitute* " approximately 90 ".

Lines 2 and 3.—*For* " normal (size 3) facepieces " *substitute* " the normal size facepiece ".

Line 5.—*Before* " determining " *insert* " principal " and *before* " eyepiece " *insert* " position of the ".

Lines 5 and 6.—*For* " rides at a level on the face " *substitute* " is."

Paragraph 6—

Lines 3 and 14.—*For* " straps " *substitute* " elastics ".

Line 11.—*For* " strap or straps " *substitute* " elastic or elastics ".

Line 15.—*After* " loose " *insert* " or the position of the harness is too low on the back of the head ".

Paragraph 7.—*Delete* from " If " in line 1 to " out " in line 2 and *substitute* :—

" When a satisfactory tension and position of the harness has been obtained ". Amdt. 1 March, 1923

Line 4.—*For* " buckles " *substitute* " tension of the elastics ".

essential for the full width to be in contact, but the wider the contact the more comfortable will be the fit. The facepiece is so shaped that this contact, which should only be a slight pressure, is obtained automatically and independently of the elastics of the harness, the only function of which is to hold the facepiece up to the face and to carry the weight and pull of the connecting tube. The position of the facepiece on the face is controlled by the fit of the chin into the chin pocket of the facepiece so that the general direction of the pull of the harness should be upwards and backwards from the chin.

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4. *Adjustment.*—(By "adjustment" of the respirator is meant the removal of the facepiece from the haversack and the placing of it in the wearing position on the face.) Correct adjustment of the facepiece is obtained by following the detail of respirator drill. In its final position the facepiece should be square on the face, while the harness is symmetrically positioned on the back of the head.

5. *Size.*—In general it is found that ~~over 80~~ per cent. of individuals can be fitted satisfactorily with normal (size 3) facepieces. In some cases, however, where the eye to chin distance is far from the normal, an outsize may be required. The determining factor is whether the eyepiece ~~rides at a level on the face~~ such that satisfactory vision is obtained when the facepiece is correctly adjusted. In most cases a gas-tight fit is obtained irrespective of size, but incorrect sizing will lead to considerable diminution in efficiency owing to discomfort and loss of field of vision.

6. *Harness tension.*—Since fit does not depend directly upon the harness of the facepiece, the aim should be to maintain the harness ~~straps~~ as loose as is consistent with stability of the facepiece on the face. Correct harness tension is therefore best obtained by first loosening the elastics to within an inch of their ends and then, with the facepiece on the face, gradually tightening up until a satisfactory tension is obtained, observing that fit invariably tends to improve when the facepiece has been worn a short time. Any tendency to leak, which, if anywhere, usually occurs in the temple region, can as a rule be overcome by *loosening* the adjacent ~~strap~~ or ~~straps~~ so as to give the fitting surface at this point greater freedom to take up its own shape in contact with the skin. The other ~~straps~~ may then require a corresponding tightening.

If the pull of the elastics as a whole is too loose, the facepiece will be found to shift on the face on vigorous and repeated turning of the head. If the pull is too tight, pressure marks will usually be visible on the wearer's face, especially on the forehead, after a short period of wear.

7. ~~If considerable readjustment of the buckles has been carried out~~, the wearer should remove the facepiece and put it on again to confirm that a satisfactory fit has been obtained. After completion of fitting the ~~buckles~~ must not be altered without authority from the gas officer or instructor.

8. Correct adjustment, size and harness tension are checked by:—

i. Visual examination.
ii. Gas chamber test.

9. *Visual examination.*—The fitting surface should provide a band of varying width in definite contact with the skin all round the face. If this band contact is discontinuous at any point the fit is unsatisfactory. When such lack of contact is suspected, confirmation can often be obtained by light pressure of the fingers on the stockinet covering this fitting band. A feeler gauge of metal or bone for insertion between the fitting surface and the skin is also often of assistance.

Page 62.—*Delete* from "It" in line 1 to "face" in line 3 and *substitute* :—

"While breathing heavily the facepiece edge may lift momentarily from the face during expiration". Amdt. 1 March, 1928

10. *Gas chamber test.*—It is difficult to guarantee the completeness of the protection afforded by a facepiece against gas by visual examination alone. The fit of the facepiece should therefore be tested in actual gas.

The best agent is a combined tear gas and nose and throat irritant, so that leaks may be detected either by the action on the eyes or, in the case of leaks in the lower portion of the facepiece, by the effect on the nose and throat. The substance used in the present lachrymatory capsule fulfils these conditions. This test should be carried out in a gas chamber under the supervision of a qualified officer.

5. Page 62, Appendix III, paragraph 11 (as amended by Amendment No. 1, notified in Army Order 40 of 1928).—*Delete* and *substitute* :—

"11. Any reasonably air-tight room or enclosed space of moderate size will serve as a gas chamber. It is desirable that the chamber should have two doors, at opposite ends, so that when both are opened a draught is created which rapidly clears the room of gas. These doors should be kept locked when the chamber is not in use. Gas chambers should not be situated within 100 yards of any road, pathway or track in frequent use, or within 100 yards of any tents, hutments, or billets where troops are quartered. Further, they should not be sited within 200 yards of any dwelling occupied by civilians. Amdt Jan 19

Should it not be possible to find a suitable room or chamber com... red... atte...

2. Page 62, Appendix III, paragraph 11 (as amended by Amendment No. 2, notified in Army Order 4 of 1929), line 14. *For* "by" *substitute* "to". Amdt 5·24

i. The clearing of the chamber should be gradual and must be arranged to occupy at least ten minutes. The partial opening of one door will generally ensure this. If the chamber has two doors, both should not be opened together.

ii. Gas chambers should not be cleared when the meteorological conditions are favourable for the travel of gas. In winter the wind velocity should be at least ten miles per hour, while in summer the early morning and late evening should be avoided, as these periods are favourable to the travel of gas.

3. Page 6 "Care hot, or th flame, ei lachryma

There is no objection to a store or barrack room being used, provided that it is well cleared and not used or slept in for 24 hours afterwards. It should, however, be noted that the frequent use of such a room will result in a certain amount of lachrymator being deposited on the walls and floor which may render it unpleasant, though not dangerous. Such accumulation of lachrymator would be diminished by washing the floor and walls at intervals as required."

The tear gas can be completely vaporized in a few minutes. An electric fan should be employed, if available, to ensure the uniform mixing of the atmosphere in the chamber. The training container, Mark II, affords complete protection against the gas produced by heating these capsules.

14. Care should be taken in handling and opening the capsules that the solid contents do not come in contact with the skin as they may produce slight inflammation and irritation, particularly in the case of people with sensitive skins. Should such cases ever occur, the best method of obtaining relief is to wash the parts affected thoroughly with soap and hot water and apply olive oil liberally.

15. Before men are sent into the gas chamber, their respirators should be inspected and the procedure to be adopted should be explained to them. When the tear gas atmosphere has been produced, respirators should be adjusted and the men should file into the chamber, walk about inside and talk. To make the test as searching as possible, men should carry out some vigorous exercise, such as jumping or physical training exercises, whilst in the chamber.

Men who detect any irritation of the eyes, nose or throat should come out and remove their facepieces. The remainder should remain in the chamber for at least five minutes. On leaving the chamber, facepieces should be removed and the men's faces examined for pressure marks.

16. All men who have detected gas, or have not been properly fitted, should be fitted with another respirator as soon as the effects of the gas have passed off, and pass through the chamber again. Before the facepiece which has admitted gas is given to another man, it must be disinfected in the prescribed manner.

17. Care should be taken in clearing the gas chamber to see that the wind is not blowing directly on to any occupied buildings in the vicinity, while all tracks and pathways down wind of the chamber should, as far as possible, be kept clear.

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while breathing etc.

~~It will frequently occur during heavy breathing that during expiration the facepiece edge will momentarily lift from the face~~, but no decrease in gas protection is produced thereby.

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11. Any reasonably air-tight room or enclosed space of moderate size will serve as a gas chamber. It is desirable that the chamber should have two doors at opposite ends so that when both are opened a draught is created which rapidly clears the room of gas. Gas chambers should not be situated within 100 yards of any road, pathway or track in frequent use, nor within 100 yards of any tents, hutments or billets where troops are quartered. Further, they should not be sited within 200 yards of any dwelling occupied by civilians. The doors should be kept locked when the chamber is not in use.

be attached.

12. The gas used for fitting is supplied in the form of lachrymatory capsules, which should be used on a scale of two for every thousand cubic feet of space in the chamber. There are two approved types of capsule, viz.,

Mark I, which consists of a gelatine capsule holding the solid tear gas. Its issue is restricted to home stations, and it should be stored so that the temperature does not exceed 45°C. (113°F.).

Mark II, which is of glass. This capsule may be issued to all stations but is primarily intended for use abroad.

There are no temperature restrictions as regards its storage.

13. The gas in the Mark I and Mark II capsules is best vaporized by placing the capsule on a tin lid in the chamber over a spirit lamp or, failing that, over a candle. Two bricks can be used to support the lid.

Before heating, the end of the Mark I capsule must be pricked with a pin, while the stem of the Mark II capsule must be broken off either by pliers or by scratching a nick on it with a file and then snapping it off with the fingers.

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Paragraph 11.—*Add* at end :—

"The above restrictions as to distance are for general guidance only and may be reduced by 50 to 60 per cent. provided that special care is exercised in the clearing of the chamber by the anti-gas instructor of the unit." Amdt March,

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3. Page 62. Appendix III.—Paragraph 13.—*After* line 4 *insert* :— Amdt. 6 Sept., 1931

"Care should be taken that the tin lid does not become red hot, or that the capsule does not come in contact with a naked flame, either of which will cause ignition and result in all lachrymatory effects being lost."

must be broken off either by pliers or by scratching a nick on it with a file and then snapping it off with the fingers.

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Should it not be possible to find a suitable room or chamber complying with these conditions, the safety distances may be reduced by one quarter of those stated above, provided that attention is paid to the following points :—

i. The clearing of the chamber should be gradual and must be arranged to occupy at least ten minutes. The partial opening of one door will generally ensure this. If the chamber has two doors, both should not be opened together.

ii. Gas chambers should not be cleared when the meteorological conditions are favourable for the travel of gas. In winter the wind velocity should be at least ten miles per hour, while in summer the early morning and late evening should be avoided, as these periods are favourable to the travel of gas.

There is no objection to a store or barrack room being used, provided that it is well cleared and not used or slept in for 24 hours afterwards. It should, however, be noted that the frequent use of such a room will result in a certain amount of lachrymator being deposited on the walls and floor which may render it unpleasant, though not dangerous. Such accumulation of lachrymator would be diminished by washing the floor and walls at intervals as required."

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